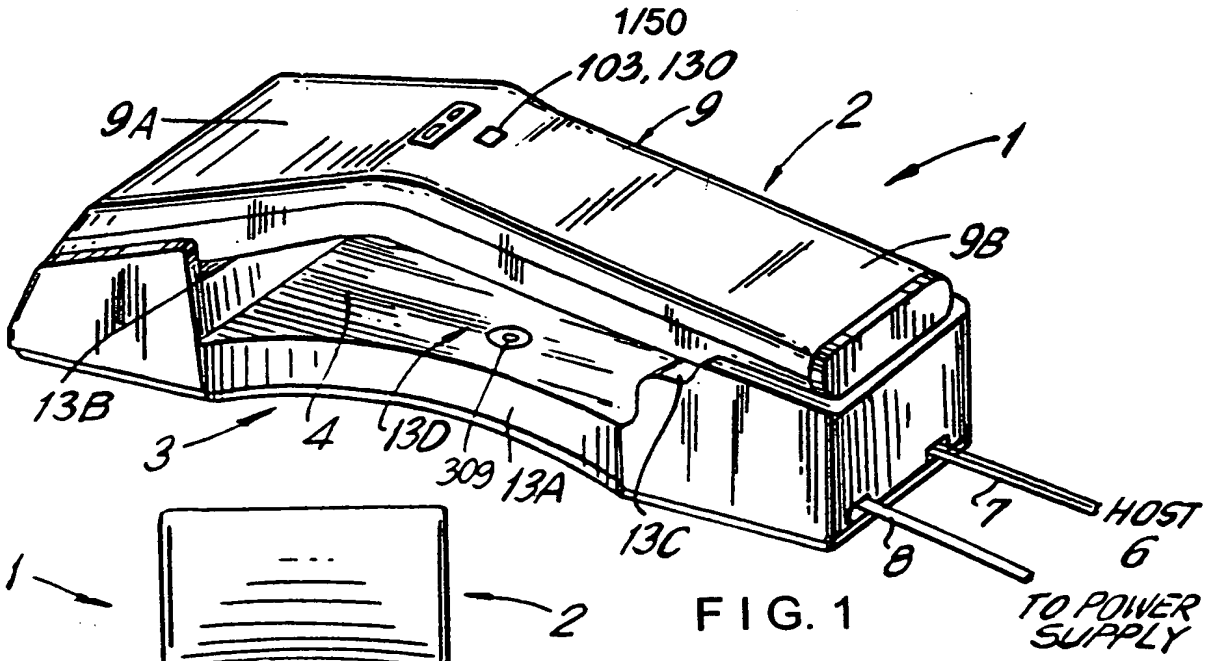


FIG. 1

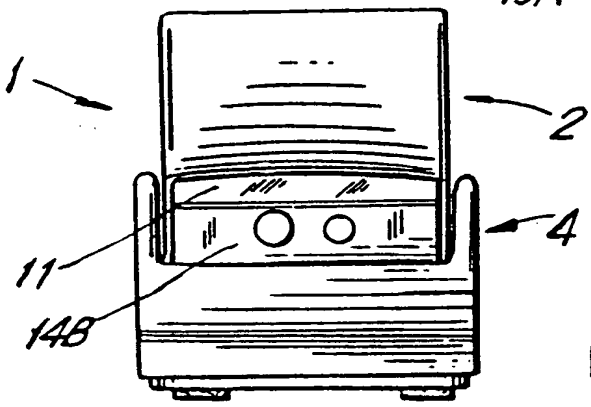


FIG. 1A

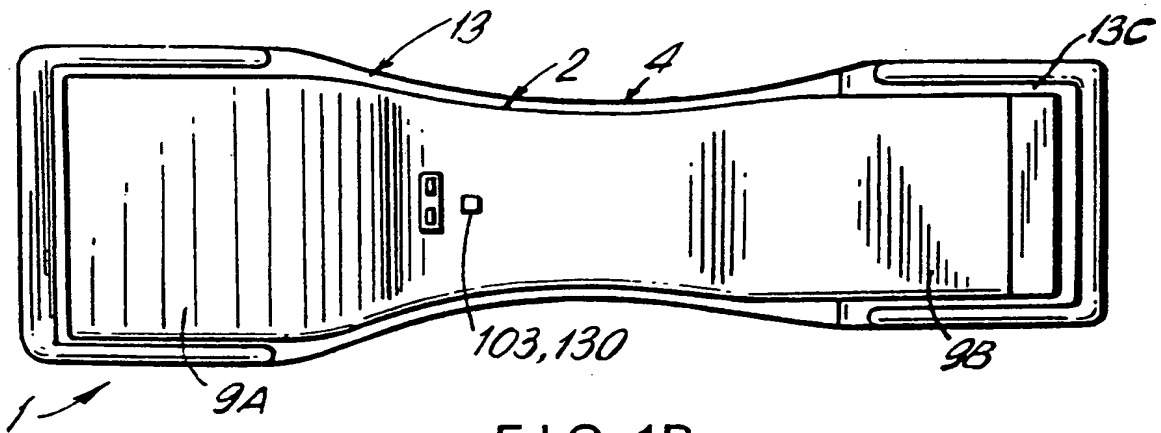


FIG. 1B

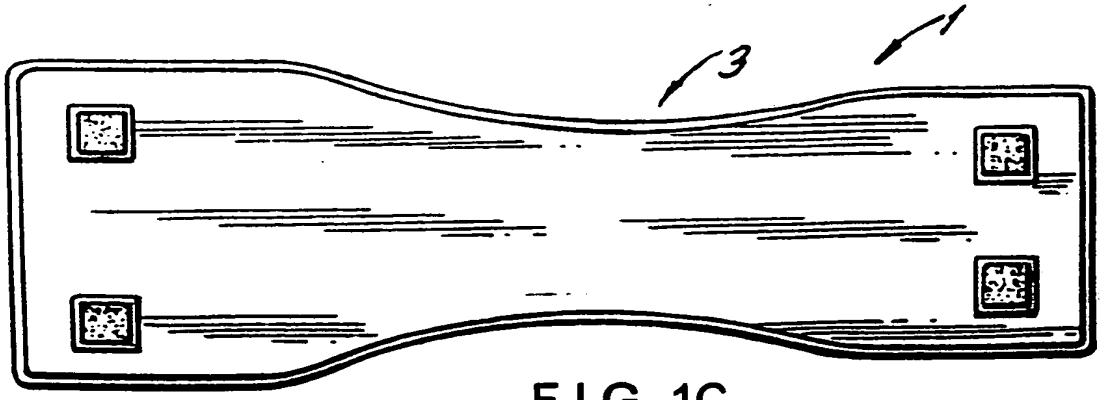


FIG. 1C

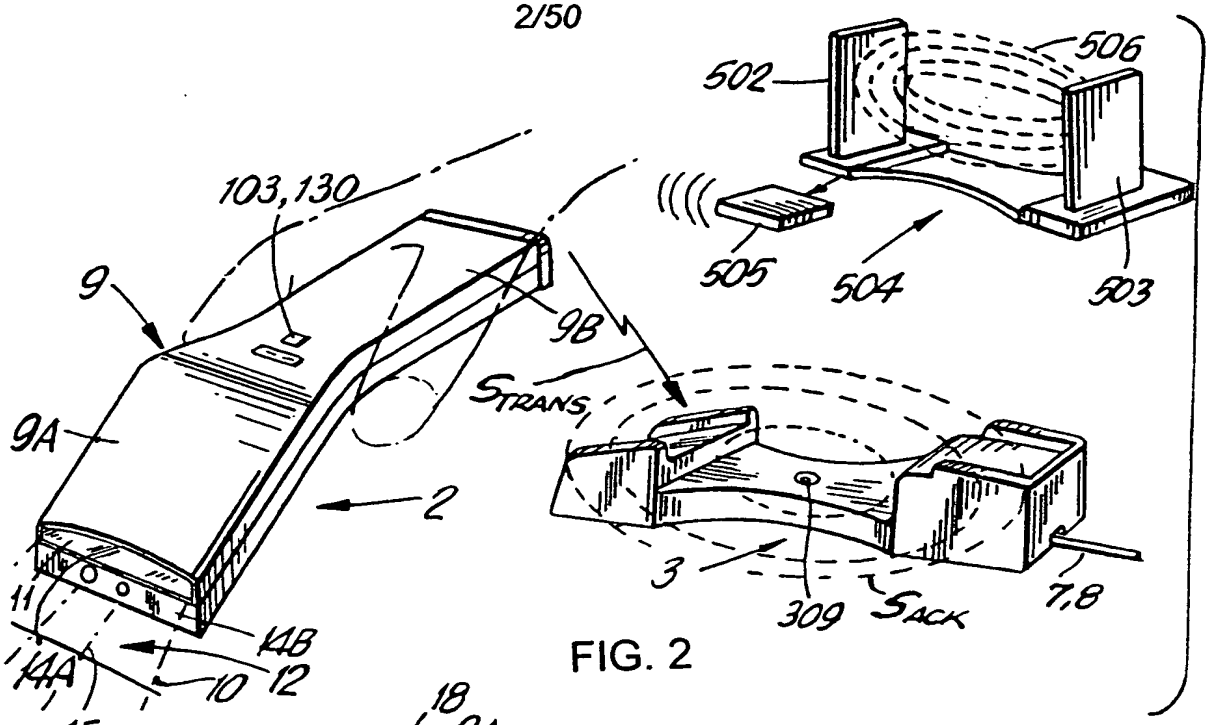


FIG. 2

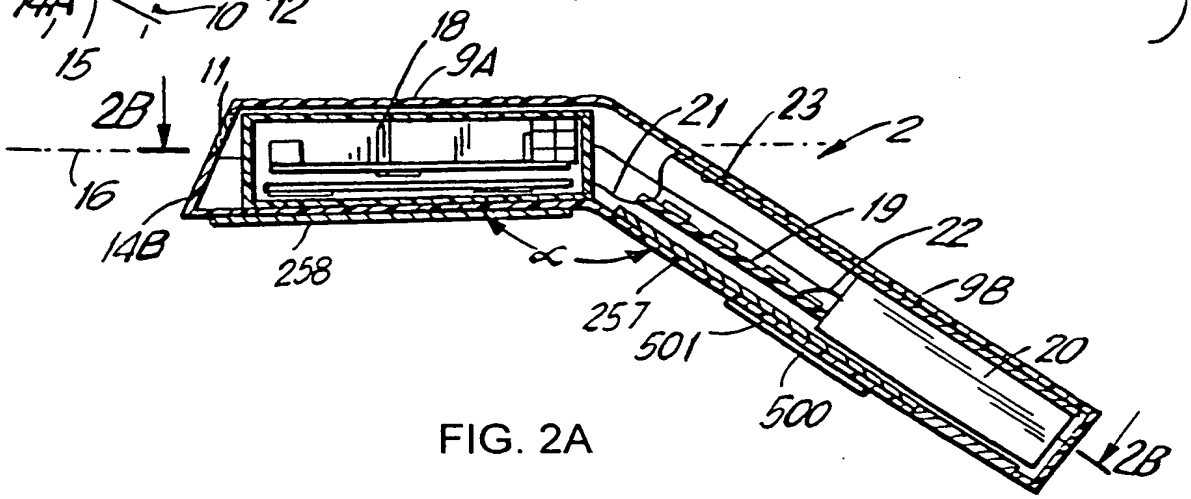


FIG. 2A

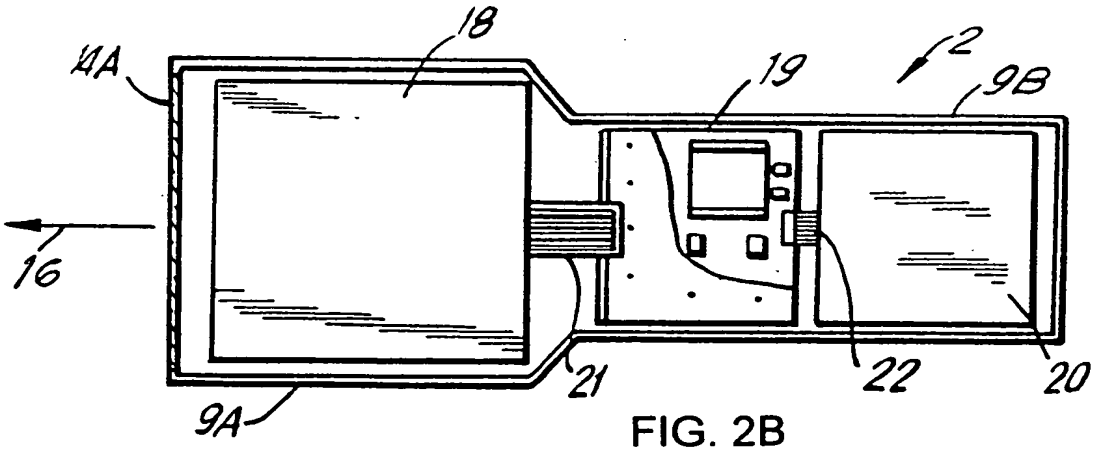


FIG. 2B

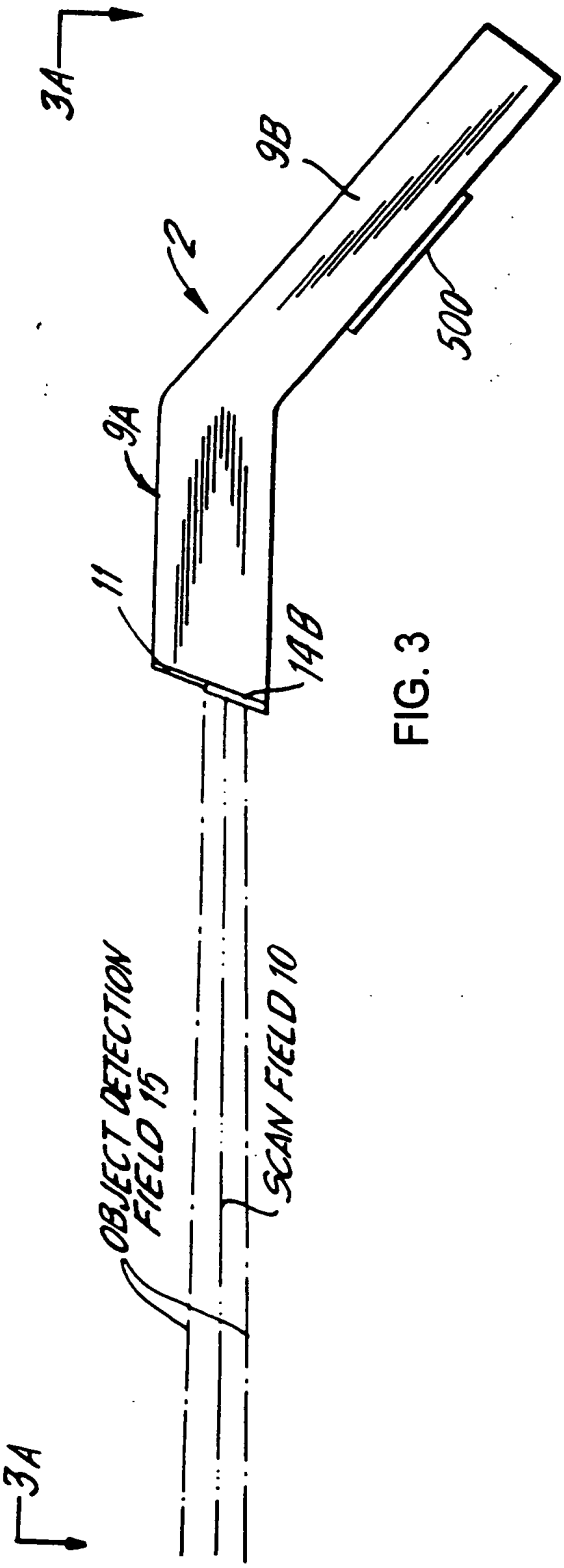

3A
98
2
500
9A
11
14B
OBJECT DETECTION FIELD 15
SCAN FIELD 10
3A

FIG. 3

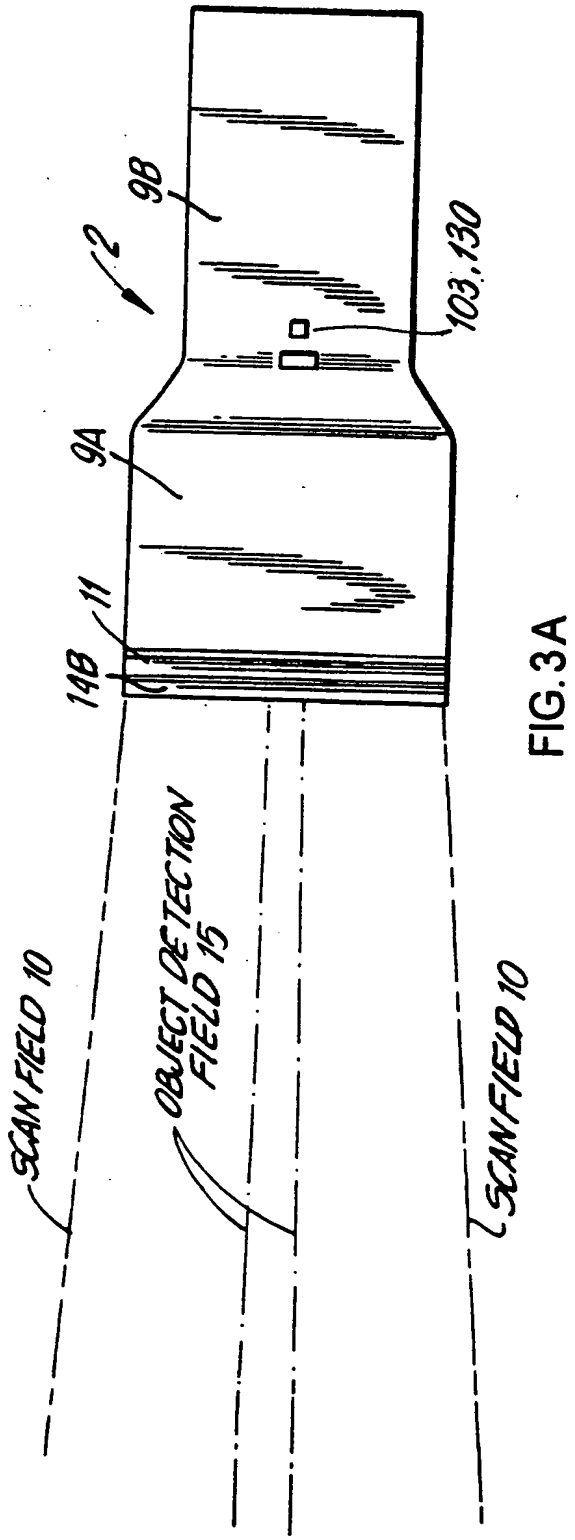

98
2
103,130
9A
11
14B
SCAN FIELD 10
OBJECT DETECTION FIELD 15
SCAN FIELD 10

FIG. 3A

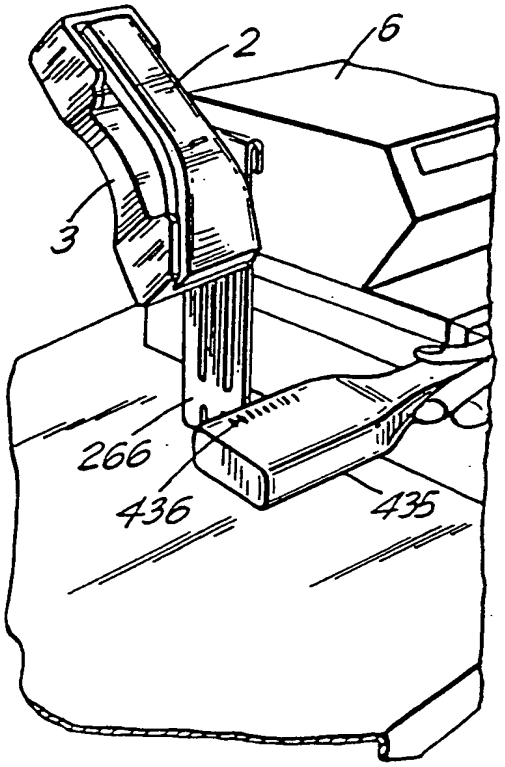


FIG. 4A

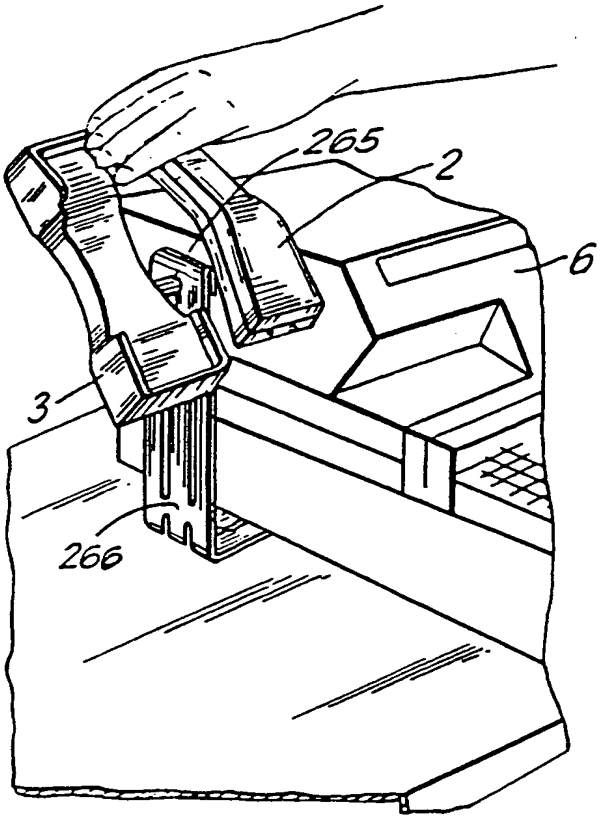


FIG. 4B

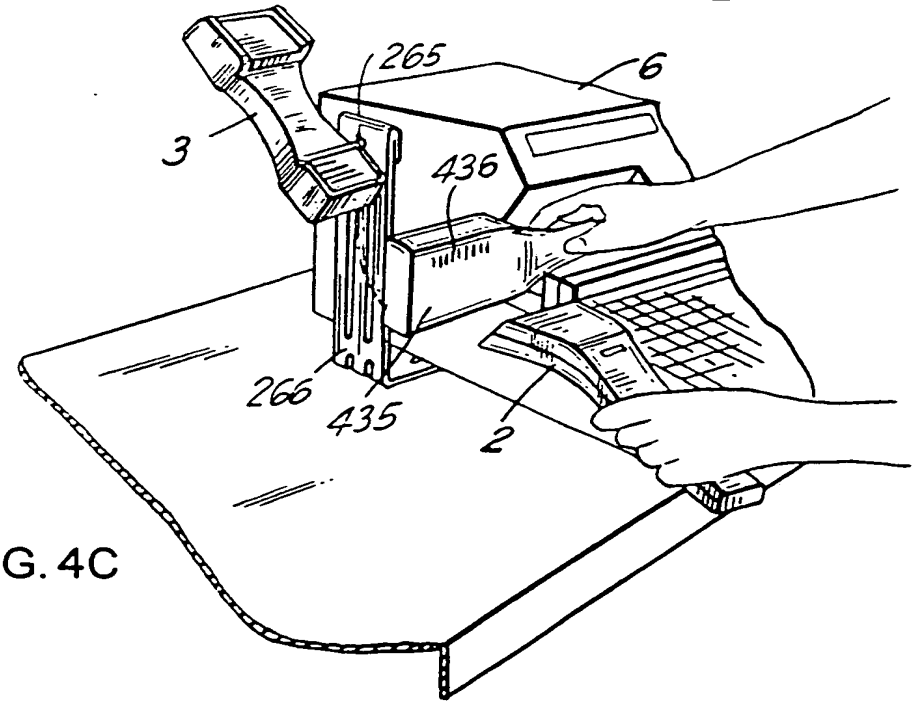


FIG. 4C

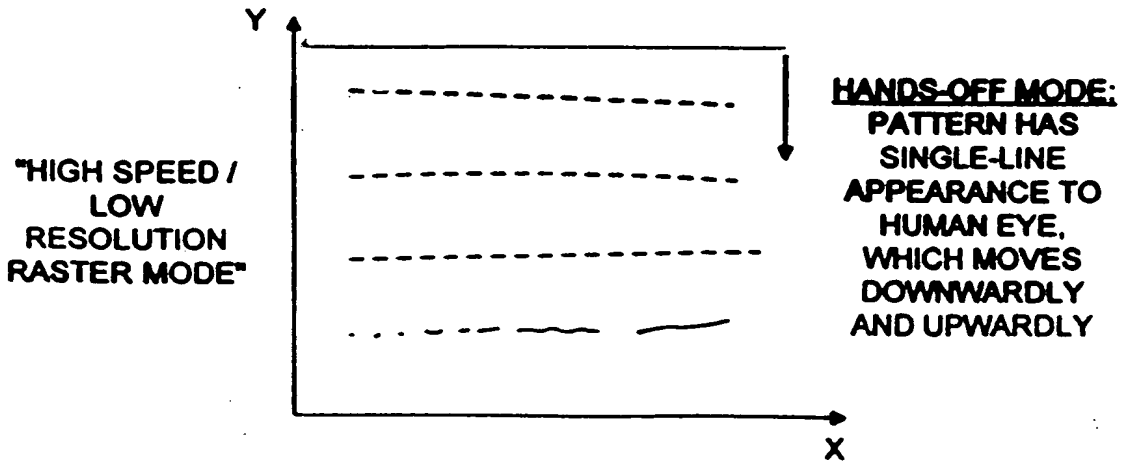


FIG. 4A1

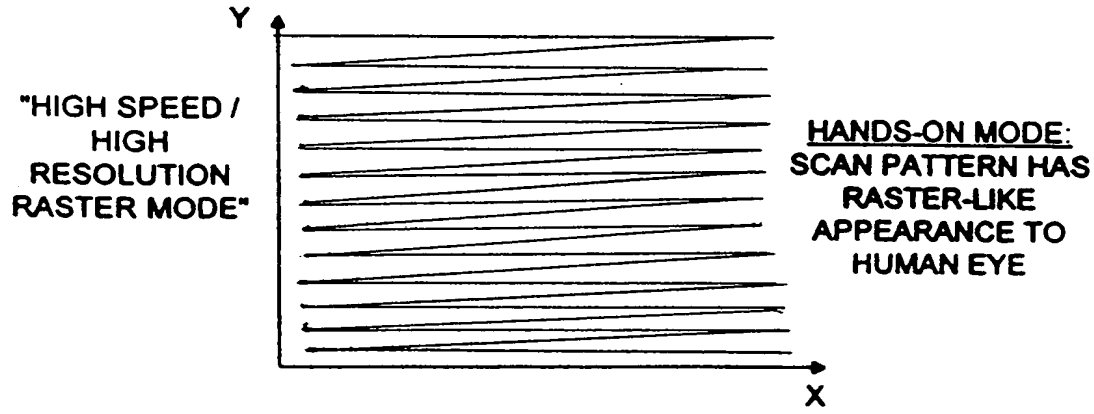


FIG. 4C1

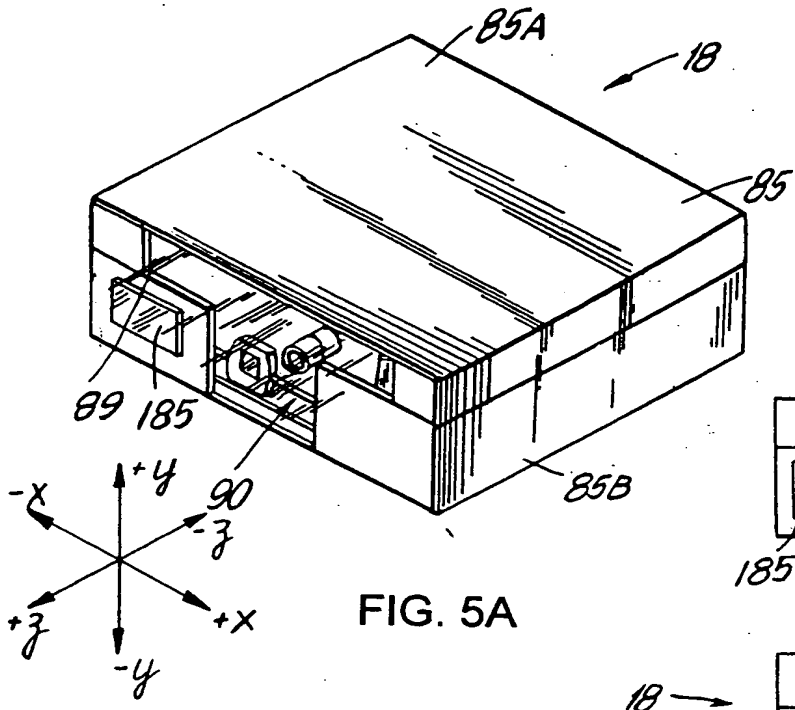


FIG. 5A

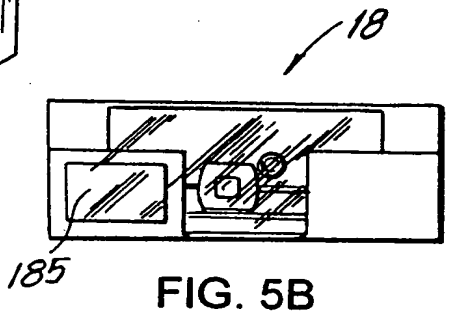


FIG. 5B

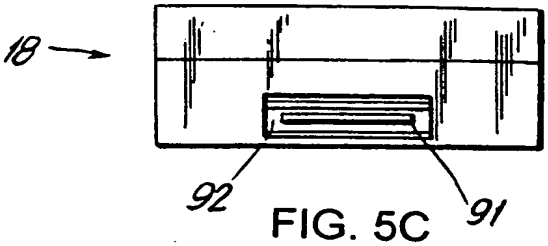


FIG. 5C

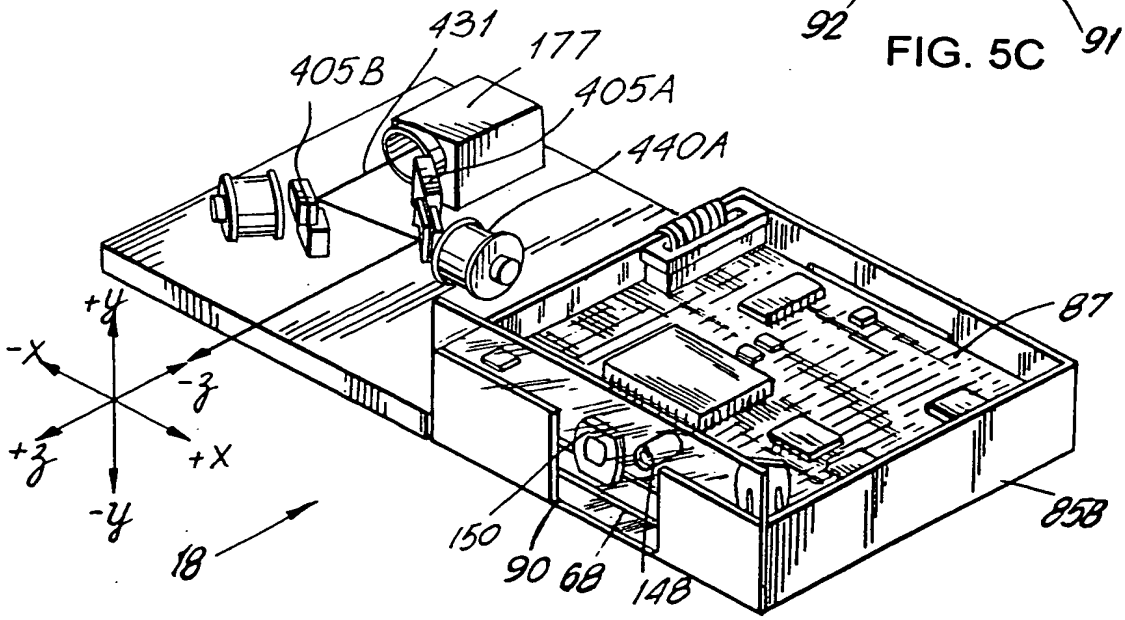


FIG. 5D

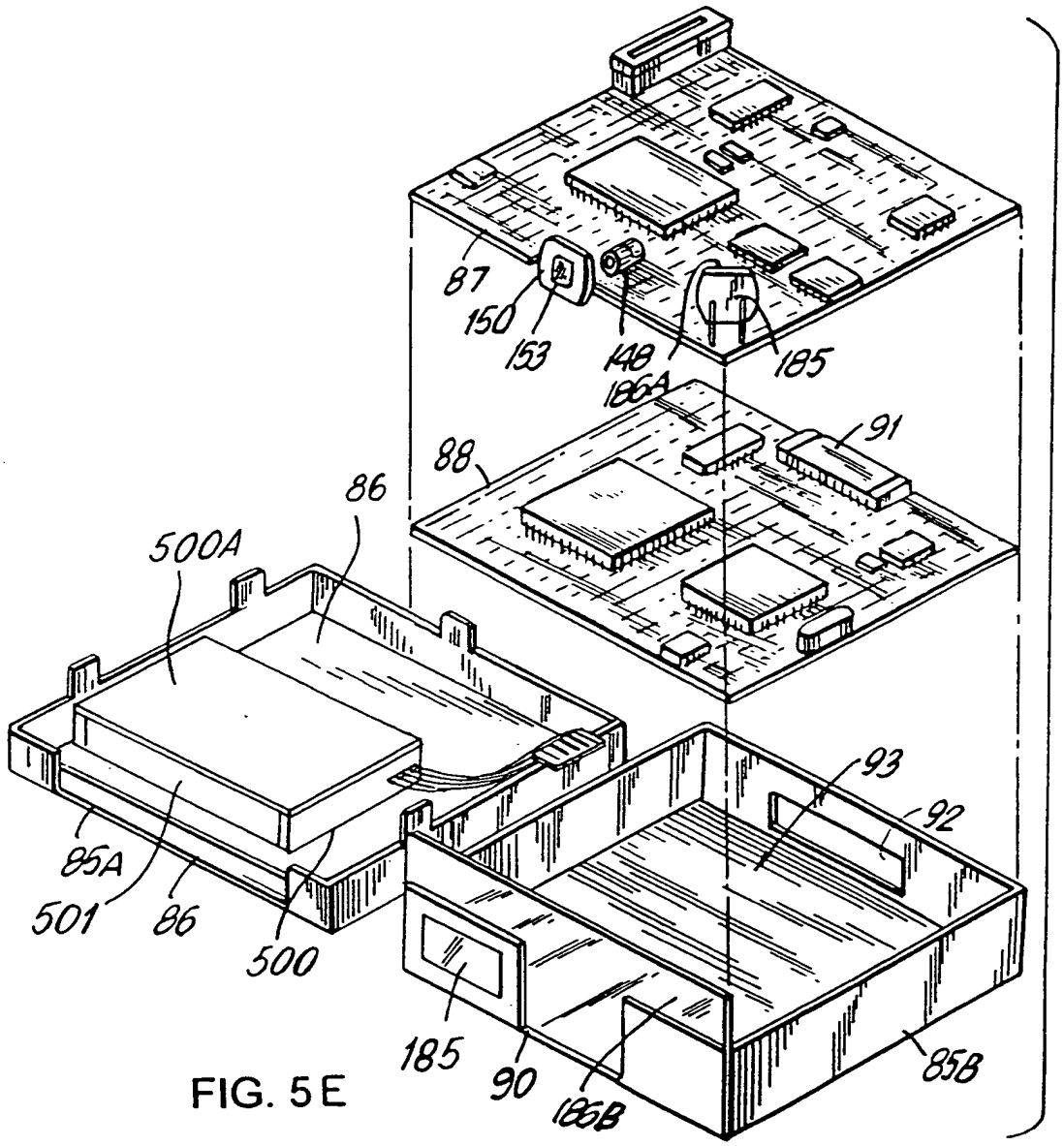

87
150
153
148
185
186A
88
91
86
500A
93
92
85A
501
86
500
185
90
186B
85B

FIG. 5E

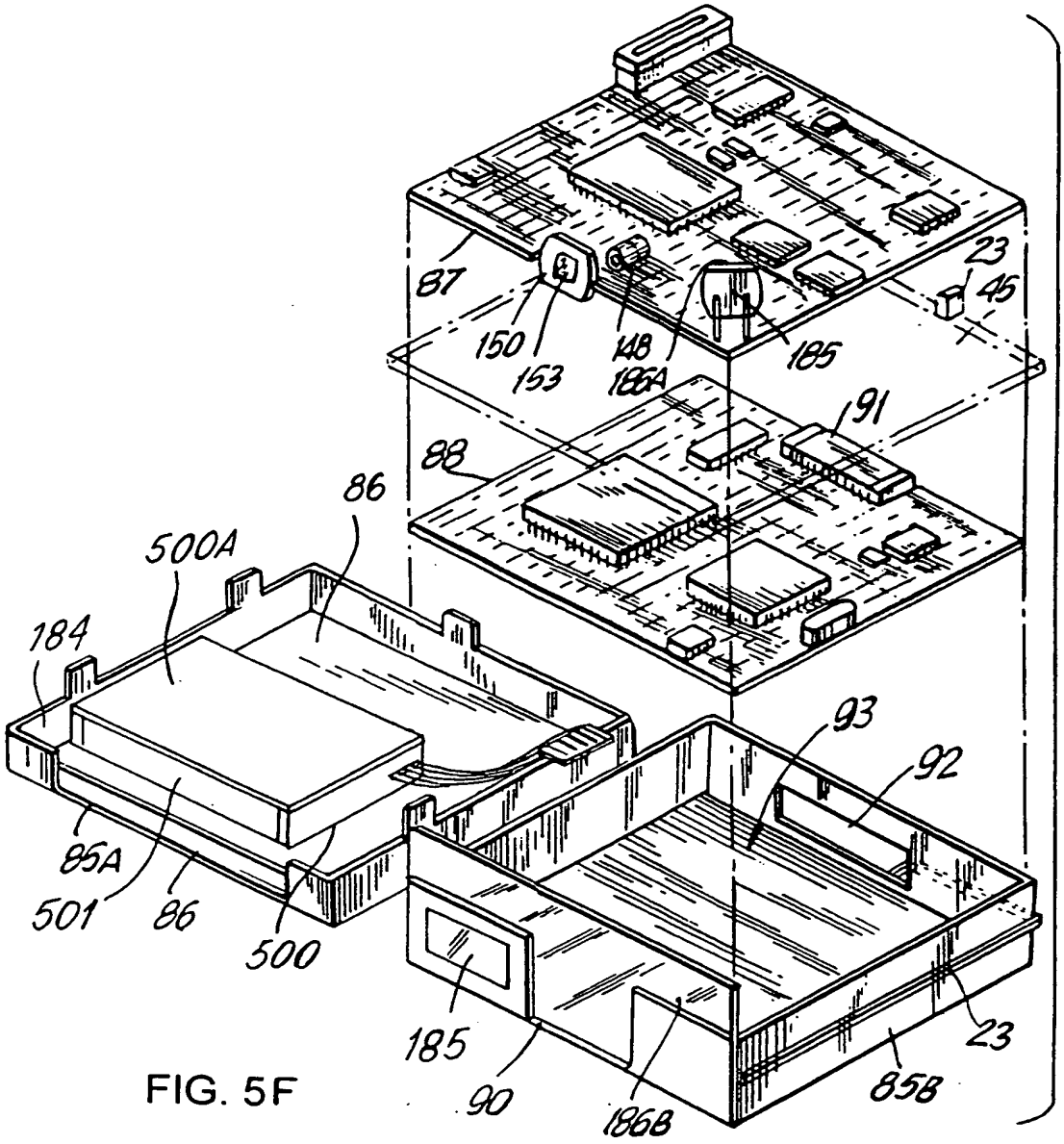

87
150
153
148
185A
185
23
45
91
88
86
500A
184
93
92
85A
501
86
500
185
90
186B
23
85B

FIG. 5F

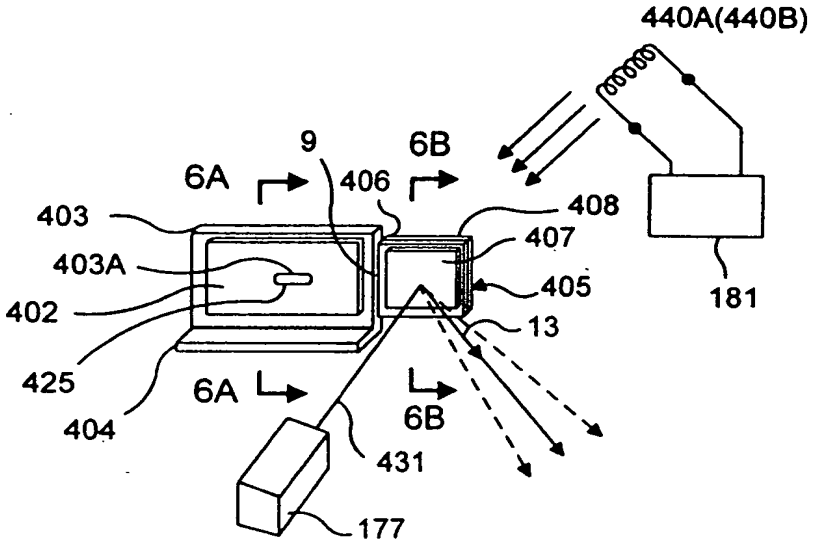


FIG. 6

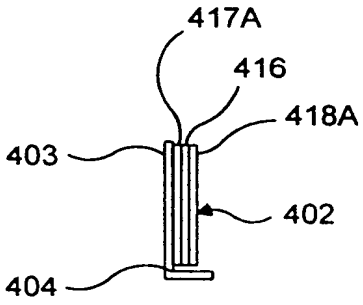


FIG. 6A

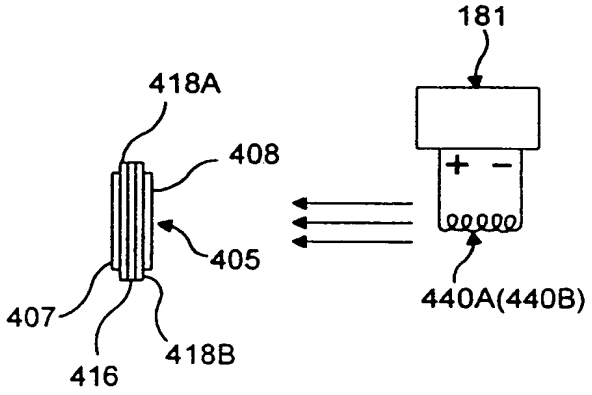


FIG. 6B

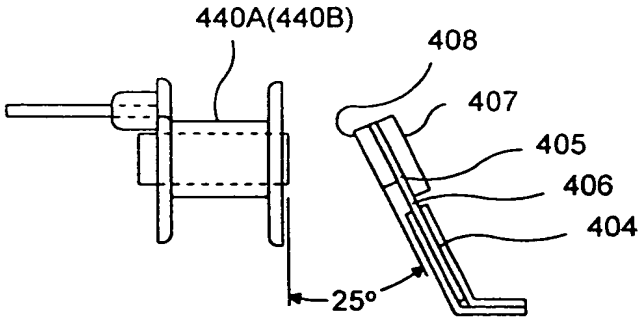


FIG. 6C

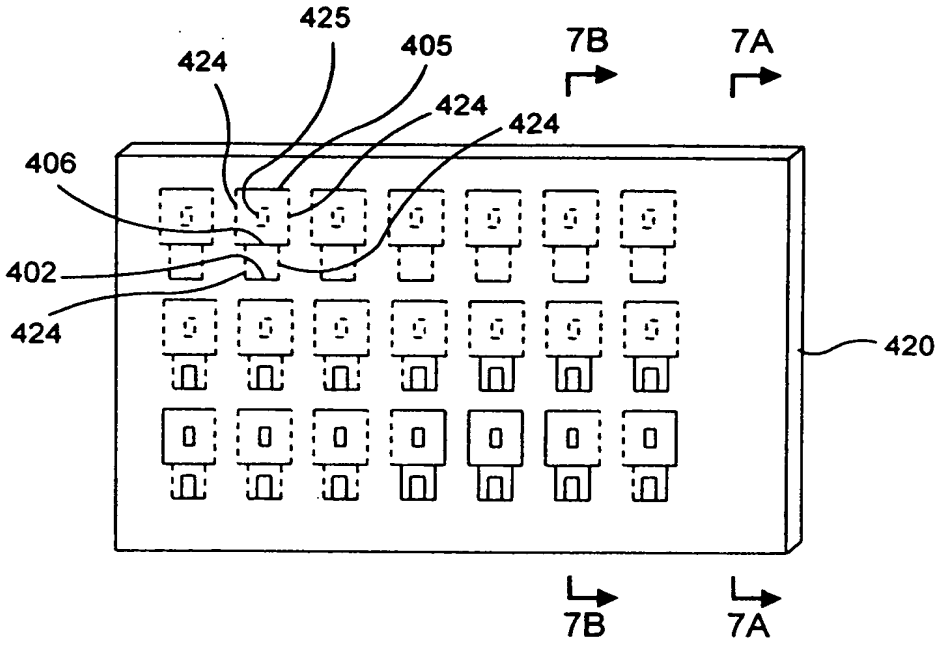


FIG. 7

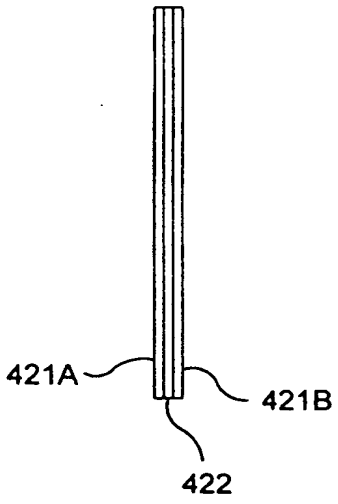


FIG. 7A

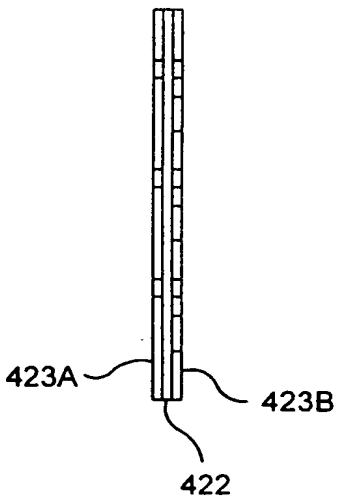


FIG. 7B

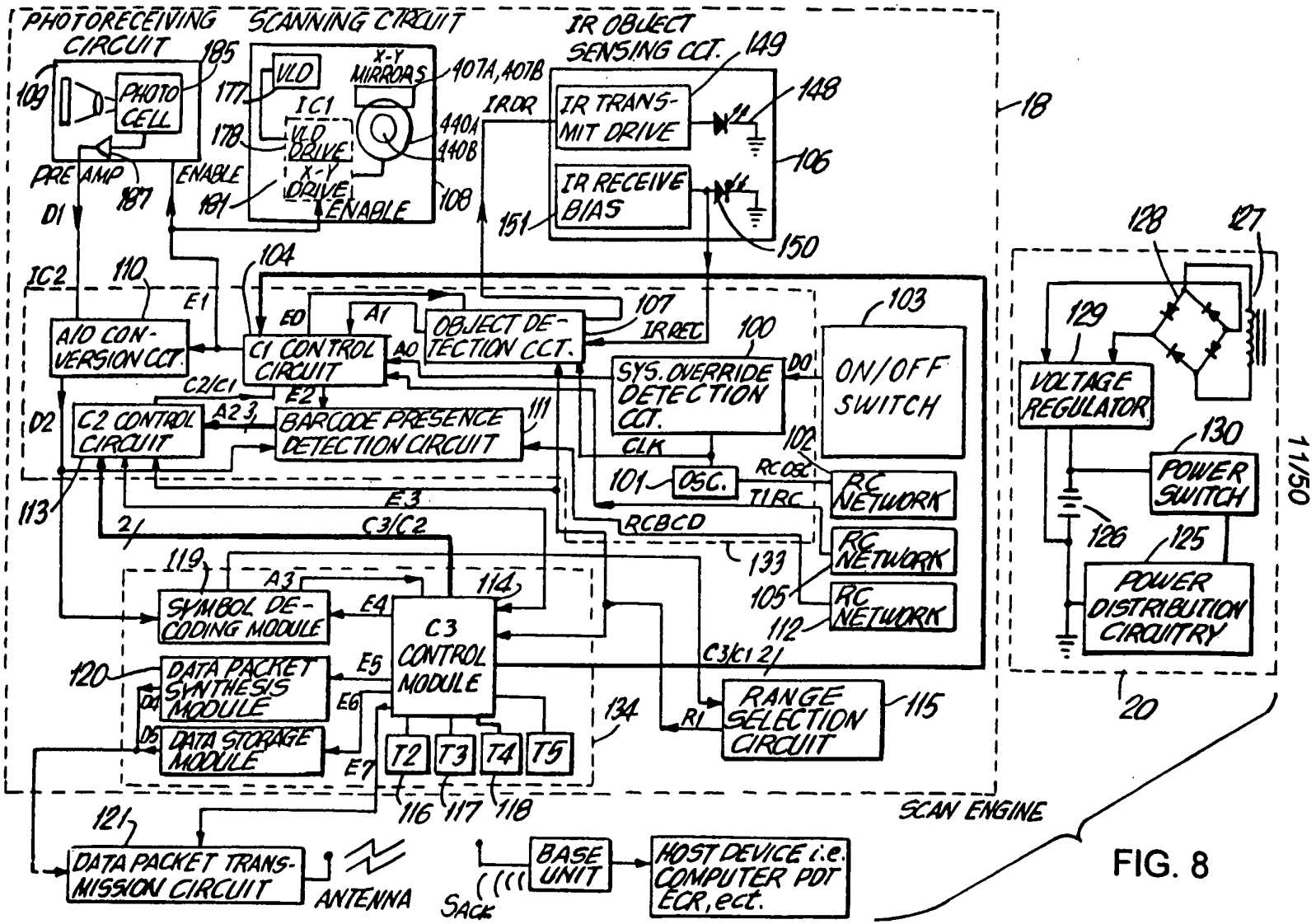

PHOTORECEIVING CIRCUIT
SCANNING CIRCUIT
IR OBJECT SENSING CCT.
PHOTO CELL
VLD
X-Y MIRRORS
IC1
VLD DRIVE
X-Y DRIVE
ENABLE
PRE AMP
IR TRANSMIT DRIVE
IR RECEIVE BIAS
A/D CONVERSION CCT.
C1 CONTROL CIRCUIT
OBJECT DETECTION CCT.
SYS. OVERRIDE DETECTION CCT.
ON/OFF SWITCH
C2 CONTROL CIRCUIT
BARCODE PRESENCE DETECTION CIRCUIT
OSC.
RC NETWORK
RC NETWORK
RC NETWORK
SYMBOL DECODING MODULE
C3 CONTROL MODULE
DATA PACKET SYNTHESIS MODULE
DATA STORAGE MODULE
RANGE SELECTION CIRCUIT
T2
T3
T4
T5
SCAN ENGINE
DATA PACKET TRANSMISSION CIRCUIT
ANTENNA
BASE UNIT
HOST DEVICE i.e. COMPUTER POT ECR, ect.
VOLTAGE REGULATOR
POWER SWITCH
POWER DISTRIBUTION CIRCUITRY
18
20
11/50

FIG. 8

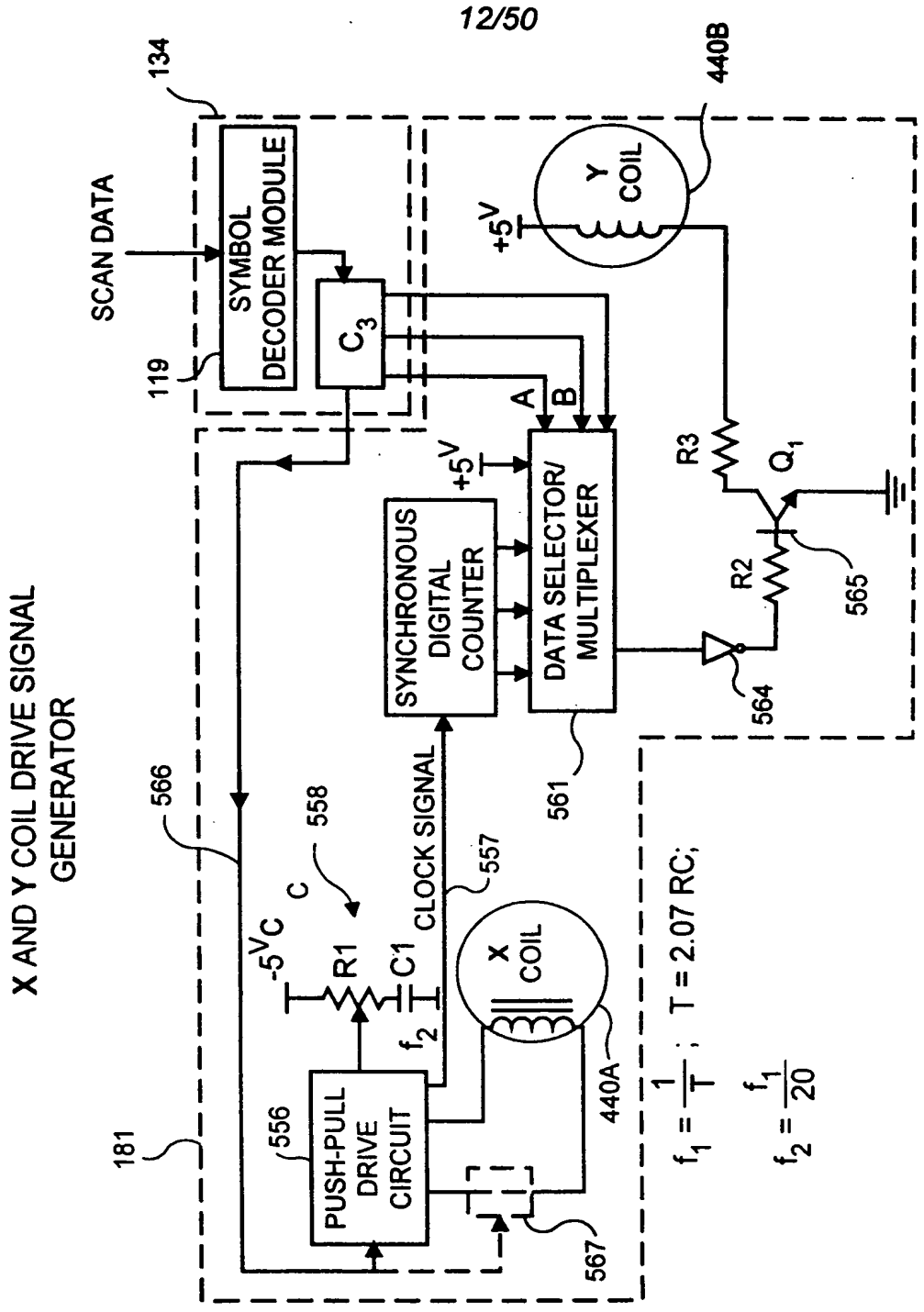

X AND Y COIL DRIVE SIGNAL GENERATOR
SCAN DATA
134
SYMBOL DECODER MODULE
119
C_3
A
B
+5V
Y COIL
440B
R3
Q_1
R2
565
564
SYNCHRONOUS DIGITAL COUNTER
DATA SELECTOR/ MULTIPLEXER
561
566
558
C
-5V
R1
C1
CLOCK SIGNAL
557
X COIL
440A
181
556
PUSH-PULL DRIVE CIRCUIT
f_2
567
$f_1 = \frac{1}{T}$; T = 2.07 RC;
$f_2 = \frac{f_1}{20}$

FIG. 8A

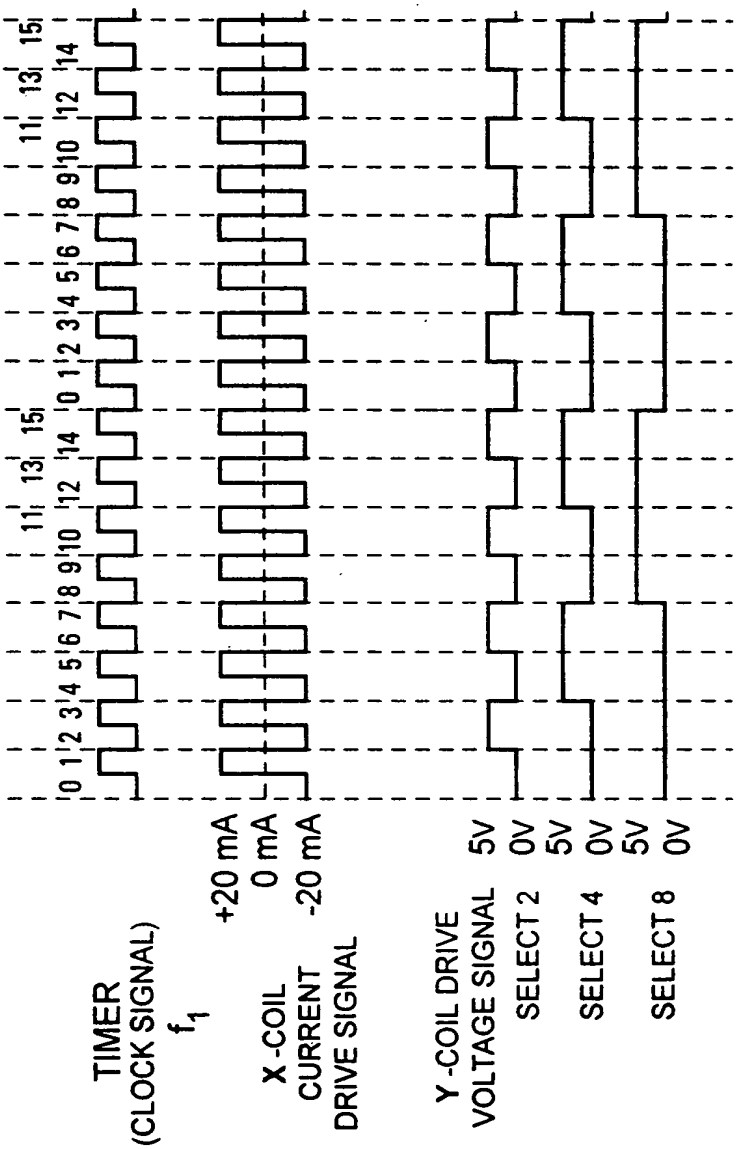


FIG. 8B1

FIG. 8B2

FIG. 8B3

FIG. 8B4

FIG. 8B5

2-LINE
RASTER

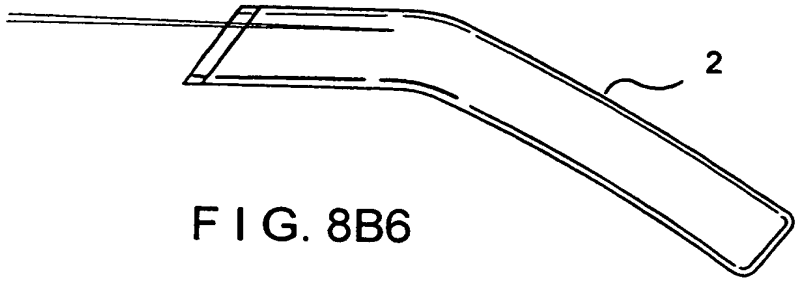


FIG. 8B6

4-LINE
RASTER

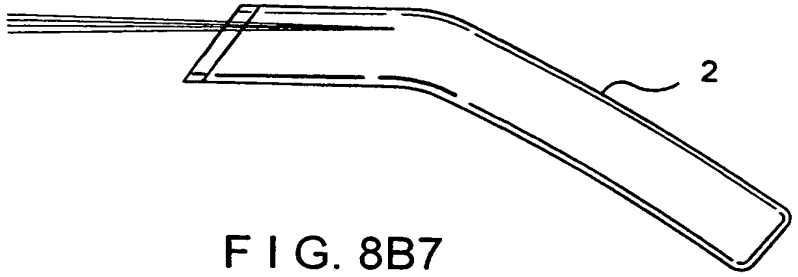


FIG. 8B7

8-LINE
RASTER

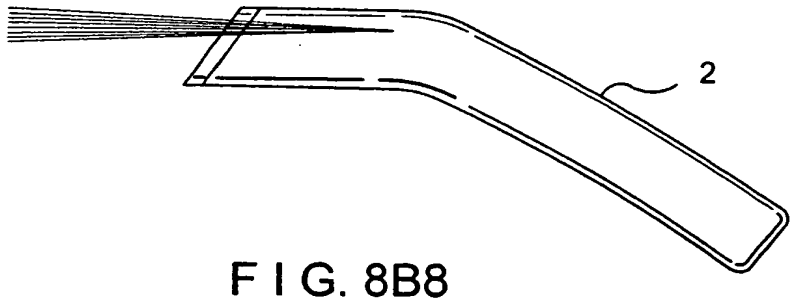


FIG. 8B8

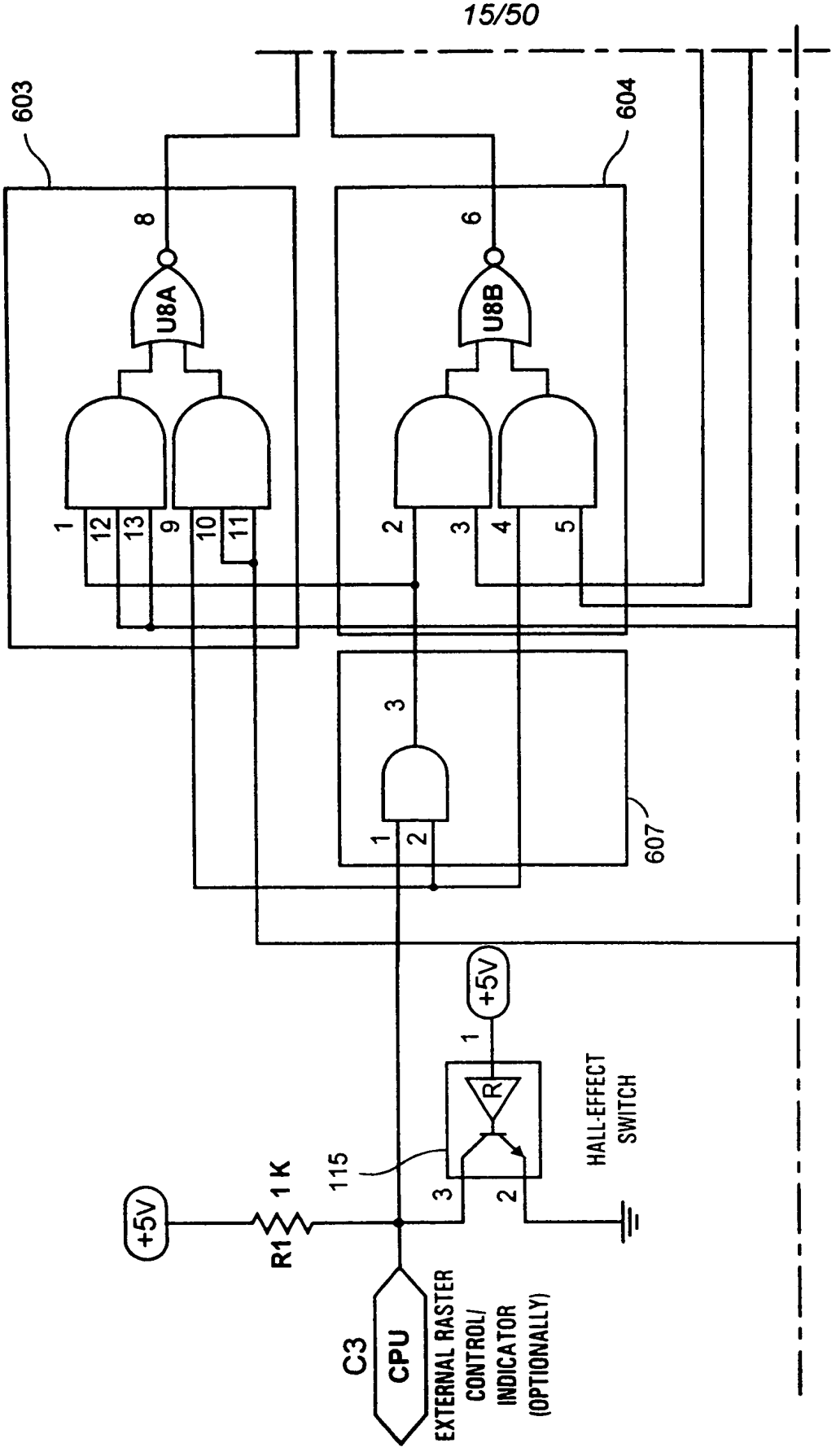

603
604
U8A
U8B
8
6
1
12
13
9
10
11
2
3
4
5
3
1
2
607
+5V
1
R
HALL-EFFECT SWITCH
115
1 K
R1
+5V
3
2
C3
CPU
EXTERNAL RASTER CONTROL/ INDICATOR (OPTIONALLY)

FIG. 8CA

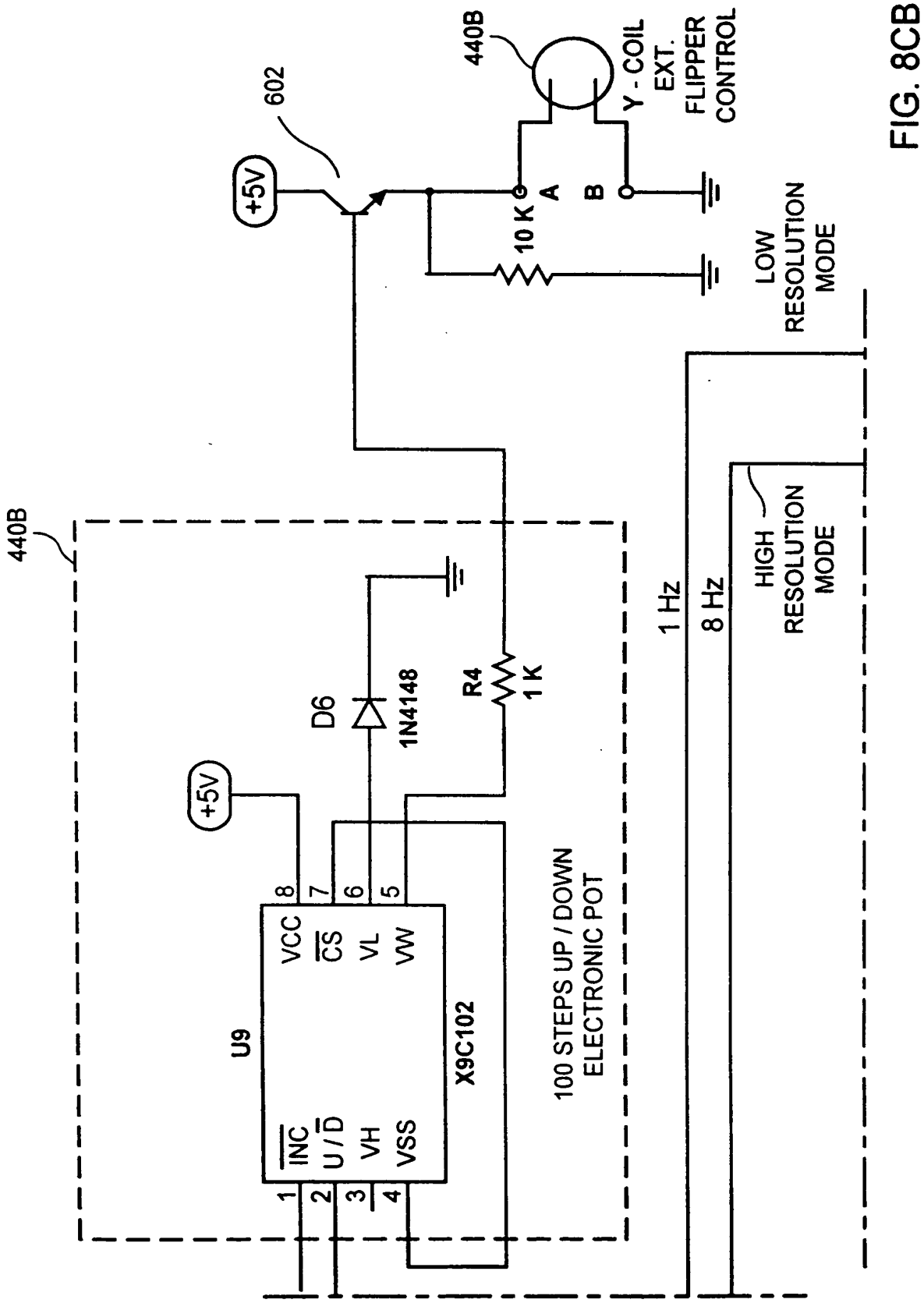

440B
Y - COIL
EXT.
FLIPPER
CONTROL
602
+5V
A
B
10 K
LOW
RESOLUTION
MODE
1 Hz
8 Hz
HIGH
RESOLUTION
MODE
440B
D6
1N4148
R4
1 K
+5V
U9
X9C102
VCC
CS
VL
VW
INC
U/D
VH
VSS
100 STEPS UP / DOWN
ELECTRONIC POT

FIG. 8CB

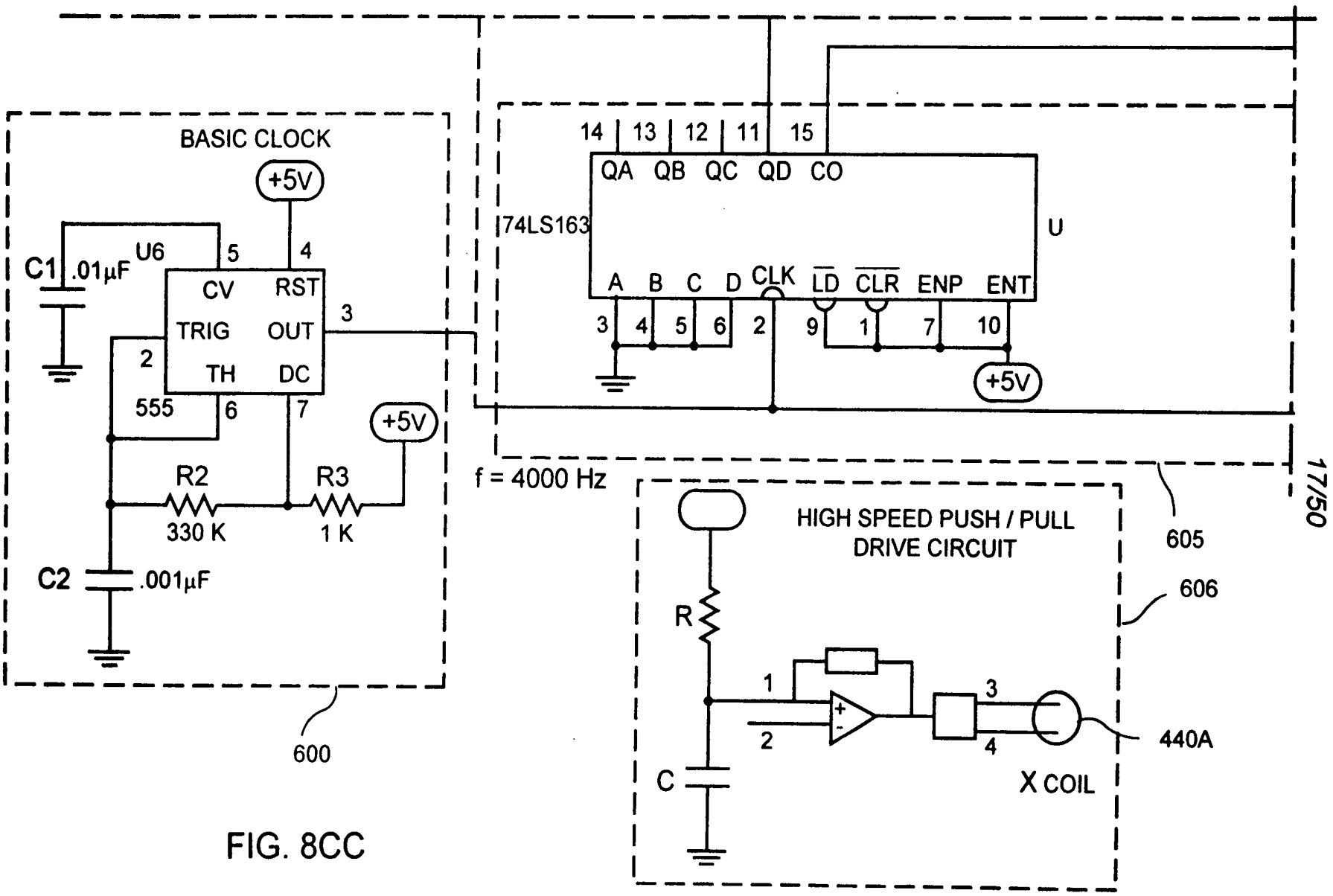

BASIC CLOCK
+5V
C1 .01μF
U6
5
4
CV
RST
TRIG
OUT
3
2
TH
DC
555
6
7
+5V
R2
R3
330 K
1 K
C2 .001μF
600
14 13 12 11 15
QA QB QC QD CO
74LS163
U
A B C D CLK LD CLR ENP ENT
3 4 5 6 2 9 1 7 10
+5V
f = 4000 Hz
605
HIGH SPEED PUSH / PULL
DRIVE CIRCUIT
606
R
1
2
3
4
440A
C
X COIL
17/50

FIG. 8CC

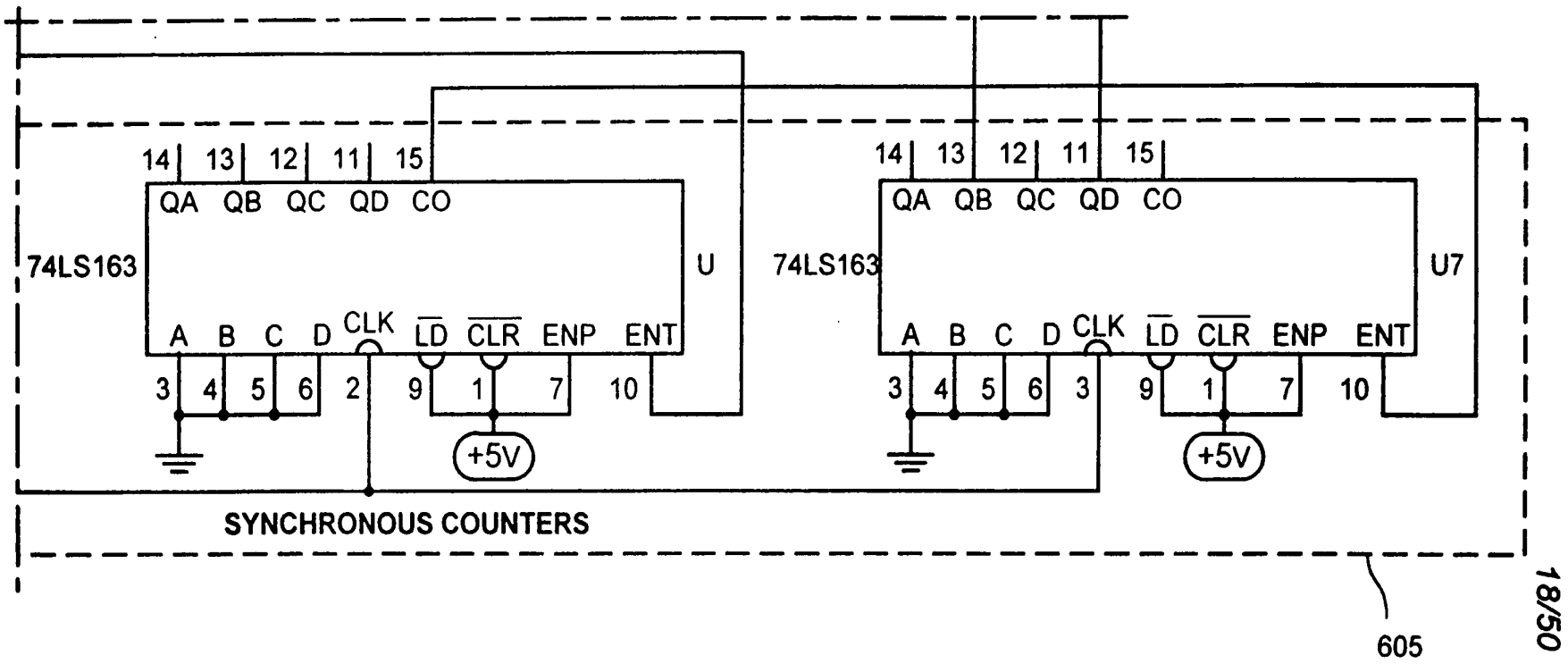

14 13 12 11 15
QA QB QC QD CO
74LS163
U
A B C D CLK LD CLR ENP ENT
3 4 5 6 2 9 1 7 10
+5V
14 13 12 11 15
QA QB QC QD CO
74LS163
U7
A B C D CLK LD CLR ENP ENT
3 4 5 6 3 9 1 7 10
+5V
SYNCHRONOUS COUNTERS
605

FIG. 8CD

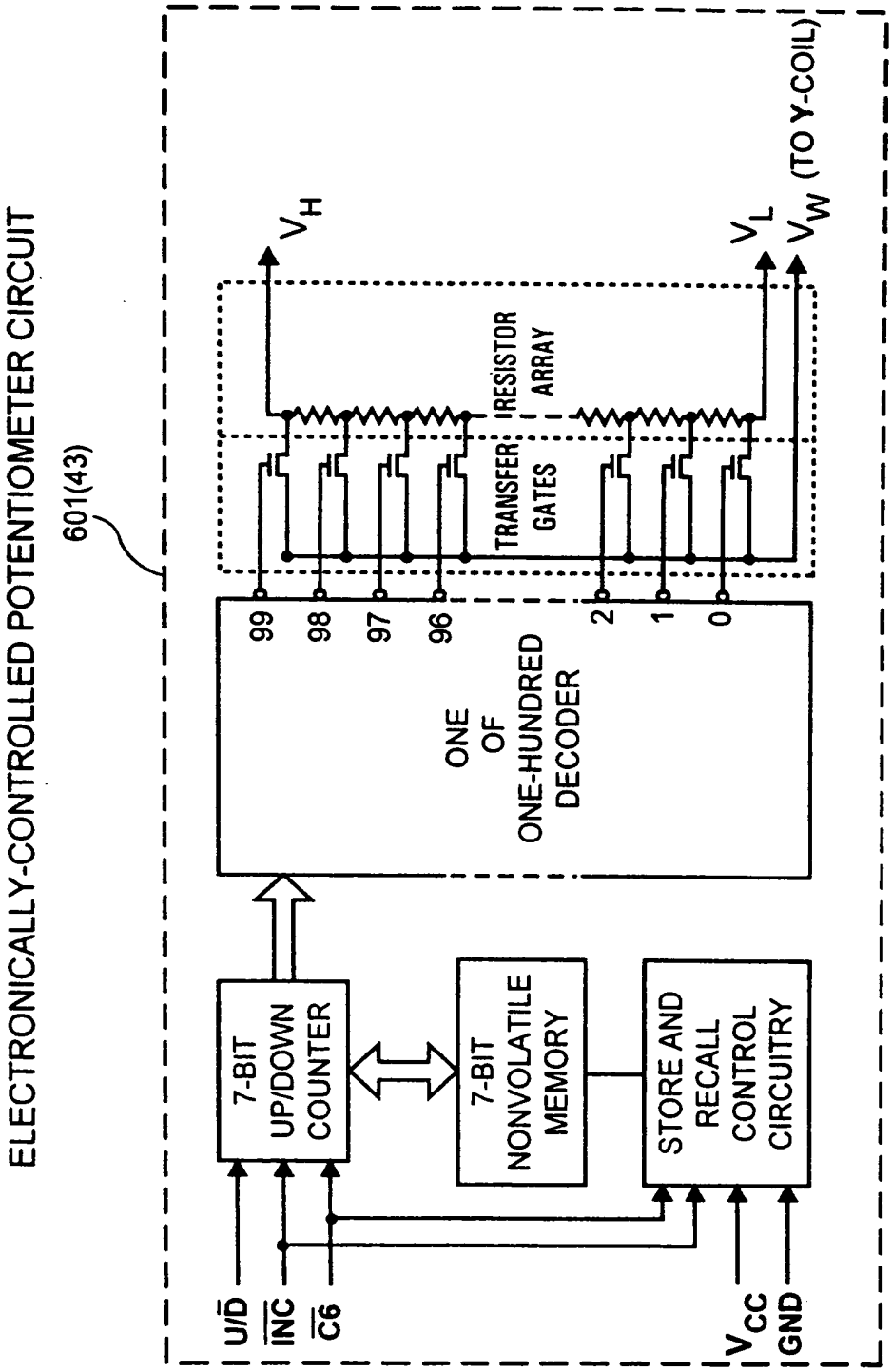

ELECTRONICALLY-CONTROLLED POTENTIOMETER CIRCUIT
601(43)
V_H
V_L
V_W (TO Y-COIL)
RESISTOR ARRAY
TRANSFER GATES
99
98
97
96
2
1
0
ONE OF ONE-HUNDRED DECODER
7-BIT UP/DOWN COUNTER
7-BIT NONVOLATILE MEMORY
STORE AND RECALL CONTROL CIRCUITRY
U/D
INC
C6
V_{CC}
GND

FIG. 8C1

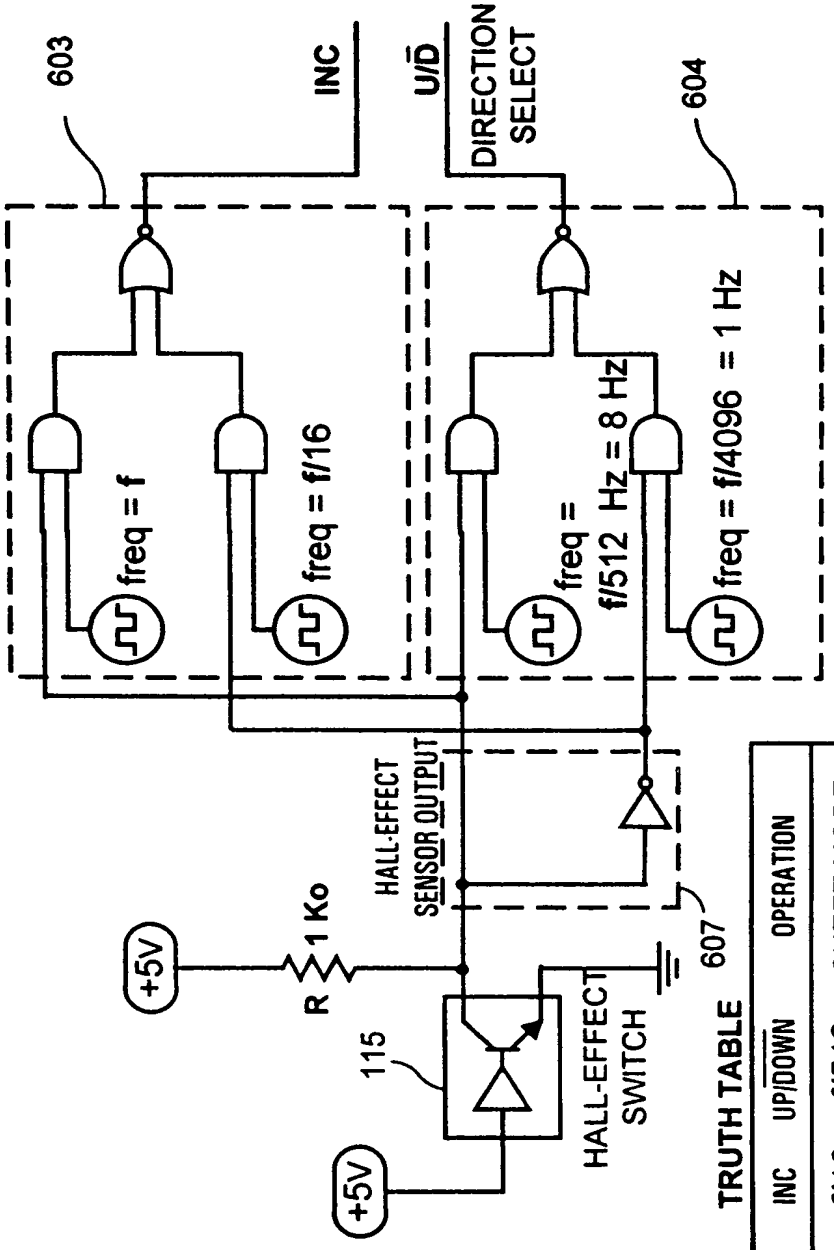

603
INC
U/D
DIRECTION SELECT
604
freq = f
freq = f/16
freq = f/512 Hz = 8 Hz
freq = f/4096 = 1 Hz
HALL-EFFECT SENSOR OUTPUT
+5V
1 Ko
R
115
+5V
HALL-EFFECT SWITCH
607
TRUTH TABLE
HALL-EFFECT OUT
INC
UP/DOWN
OPERATION
0 (IN STAND)
f/16
f/512
SHEET MODE
1 (OUT OF STAND)
f
f/1024
RASTER MODE
X-COIL FLIPPER FREQUENCY IS APPROXIMATELLY EQUAL TO f / 16

FIG. 8C2

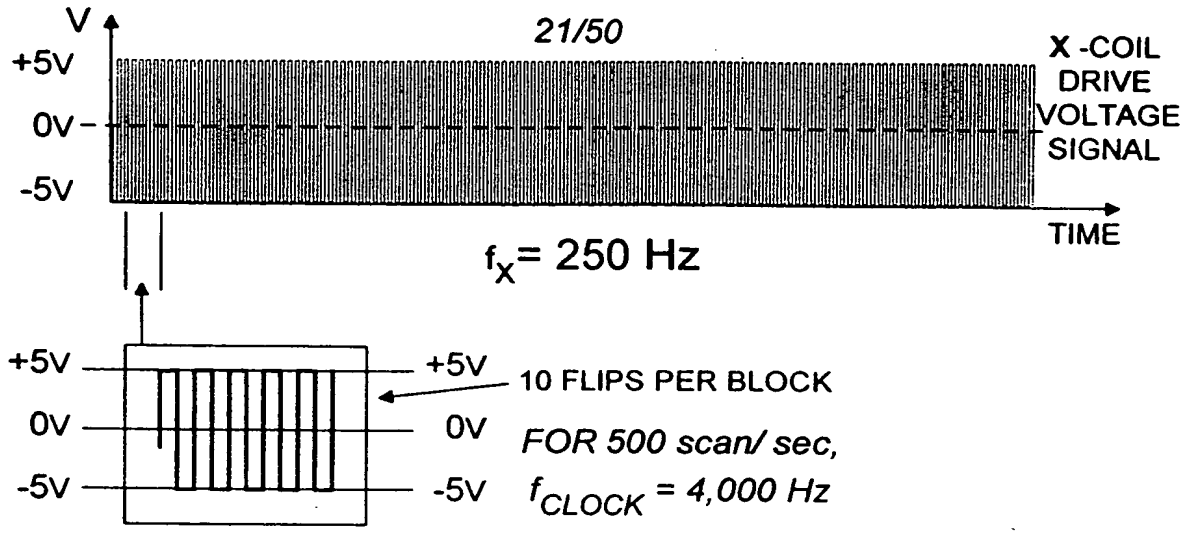


FIG. 8D1

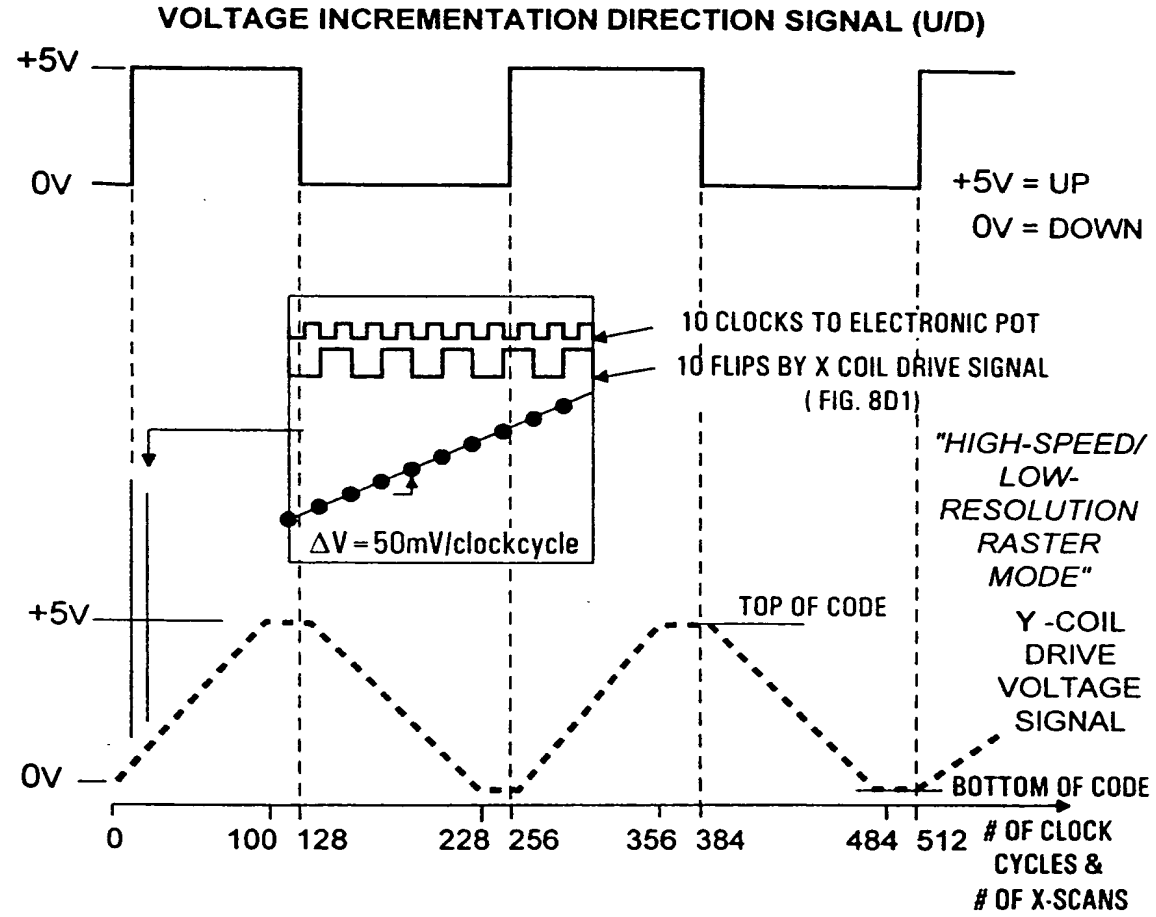
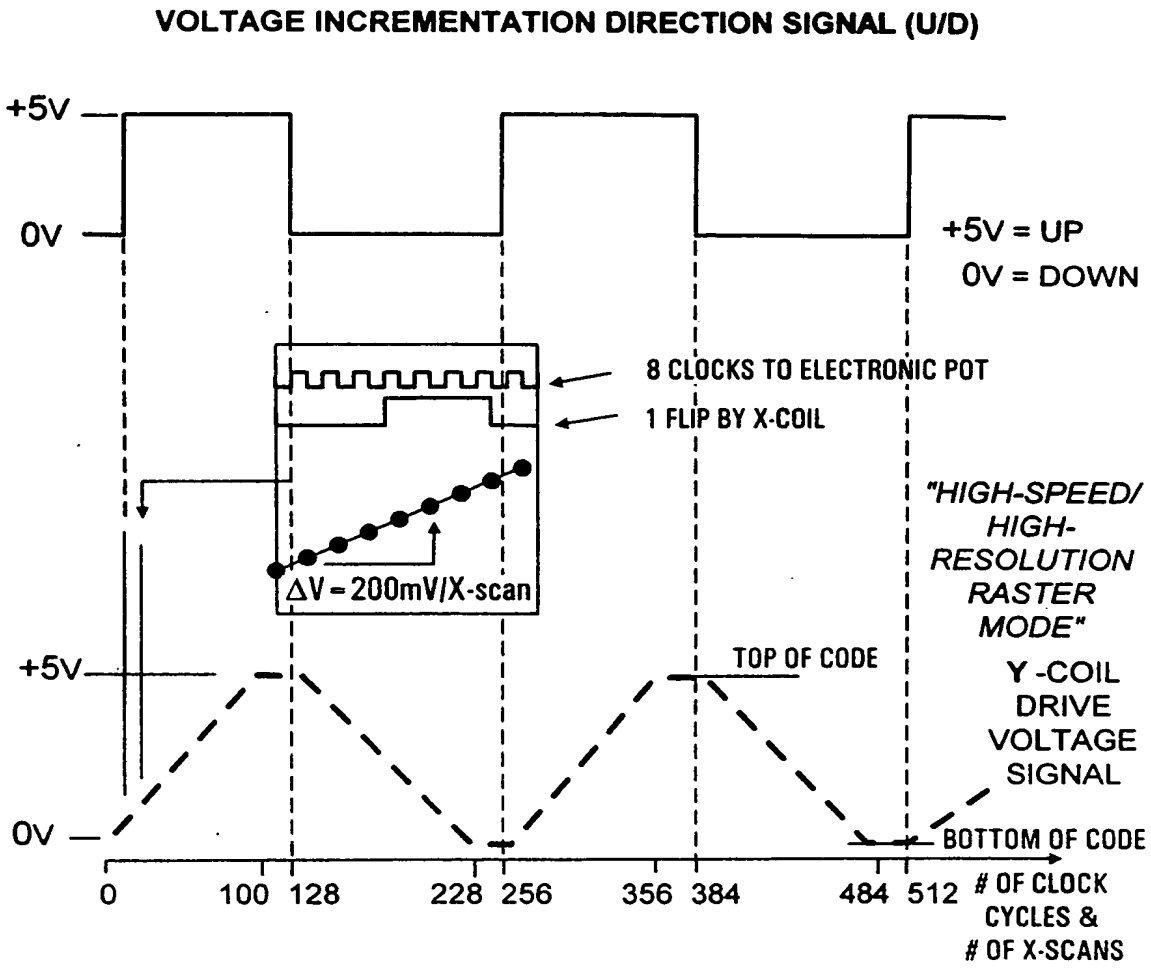


FIG. 8D2


VOLTAGE INCREMENTATION DIRECTION SIGNAL (U/D)
+5V
0V
+5V = UP
0V = DOWN
8 CLOCKS TO ELECTRONIC POT
1 FLIP BY X-COIL
ΔV = 200mV/X-scan
"HIGH-SPEED/ HIGH-RESOLUTION RASTER MODE"
+5V
TOP OF CODE
Y -COIL DRIVE VOLTAGE SIGNAL
0V
BOTTOM OF CODE
0
100
128
228
256
356
384
484
512
OF CLOCK CYCLES & # OF X-SCANS

F I G. 8D3

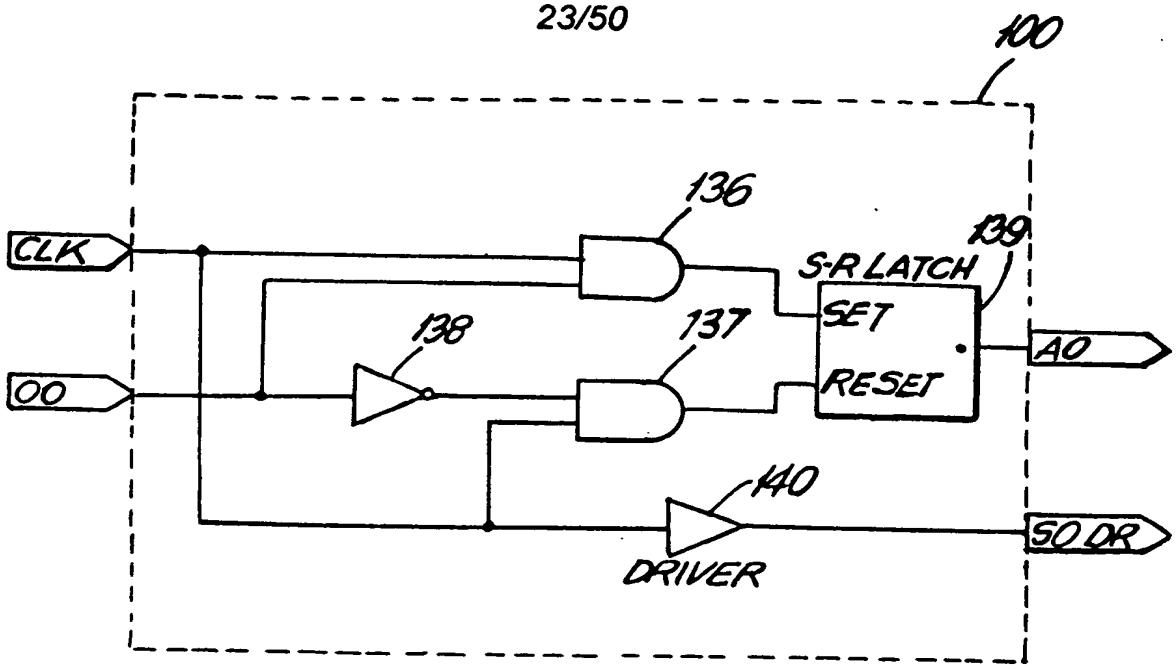

100
136
139
CLK
S-R LATCH
SET
RESET
AO
138
137
OO
140
SO OR
DRIVER

FIG. 8E

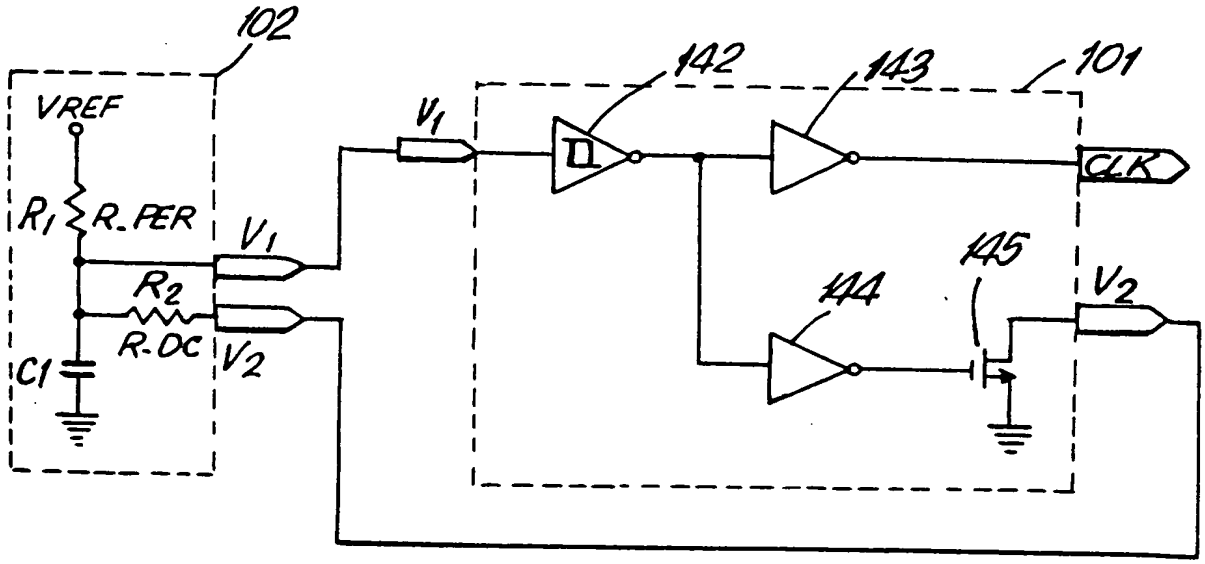

102
142
143
101
VREF
V_1
CLK
R_1
R. PER
V_1
145
R_2
144
V_2
R. OC
C1
V_2

FIG. 8F

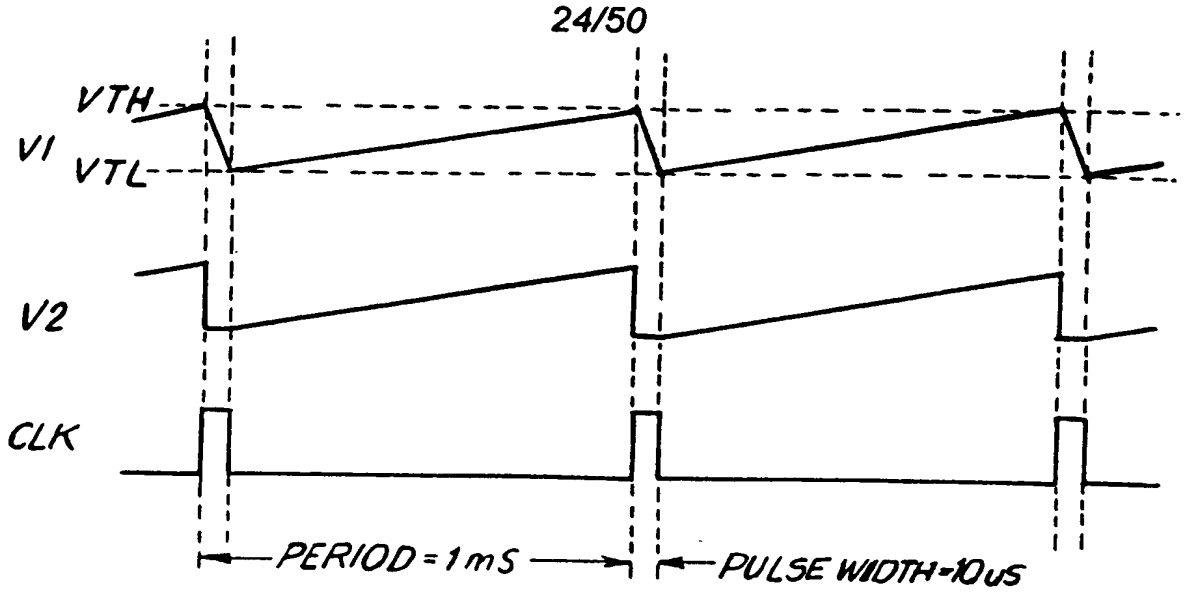

VTH
VI
VTL
V2
CLK
PERIOD = 1mS
PULSE WIDTH = 10uS

FIG. 8G

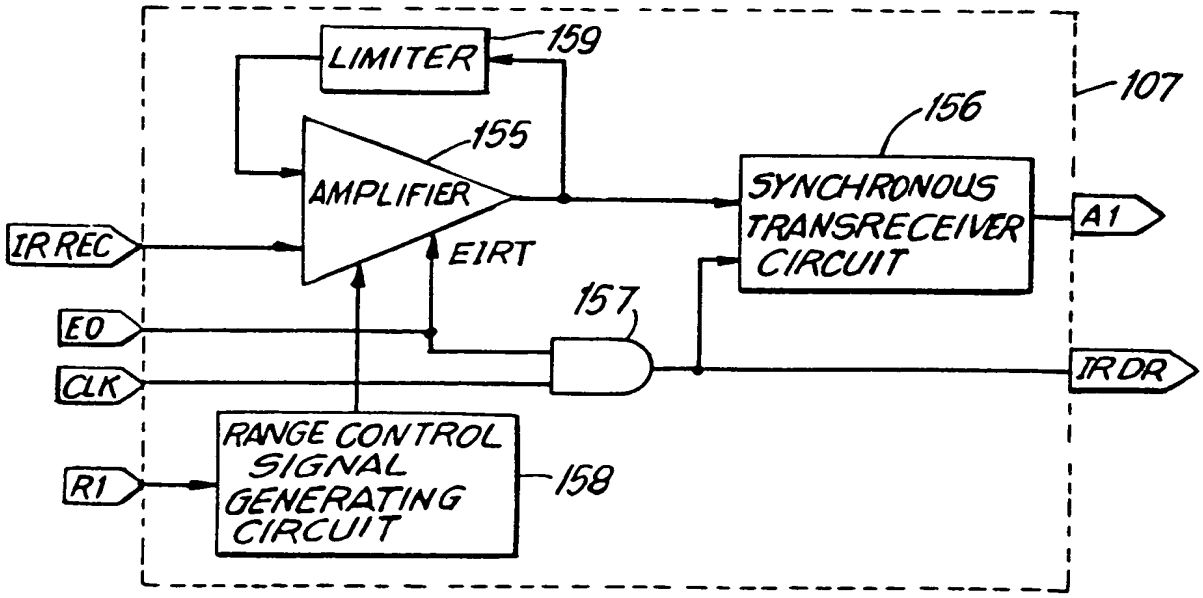

LIMITER
159
107
156
155
AMPLIFIER
SYNCHRONOUS TRANSRECEIVER CIRCUIT
A1
IR REC
EIRT
157
EO
CLK
IR DR
RANGE CONTROL SIGNAL GENERATING CIRCUIT
R1
158

FIG. 8H

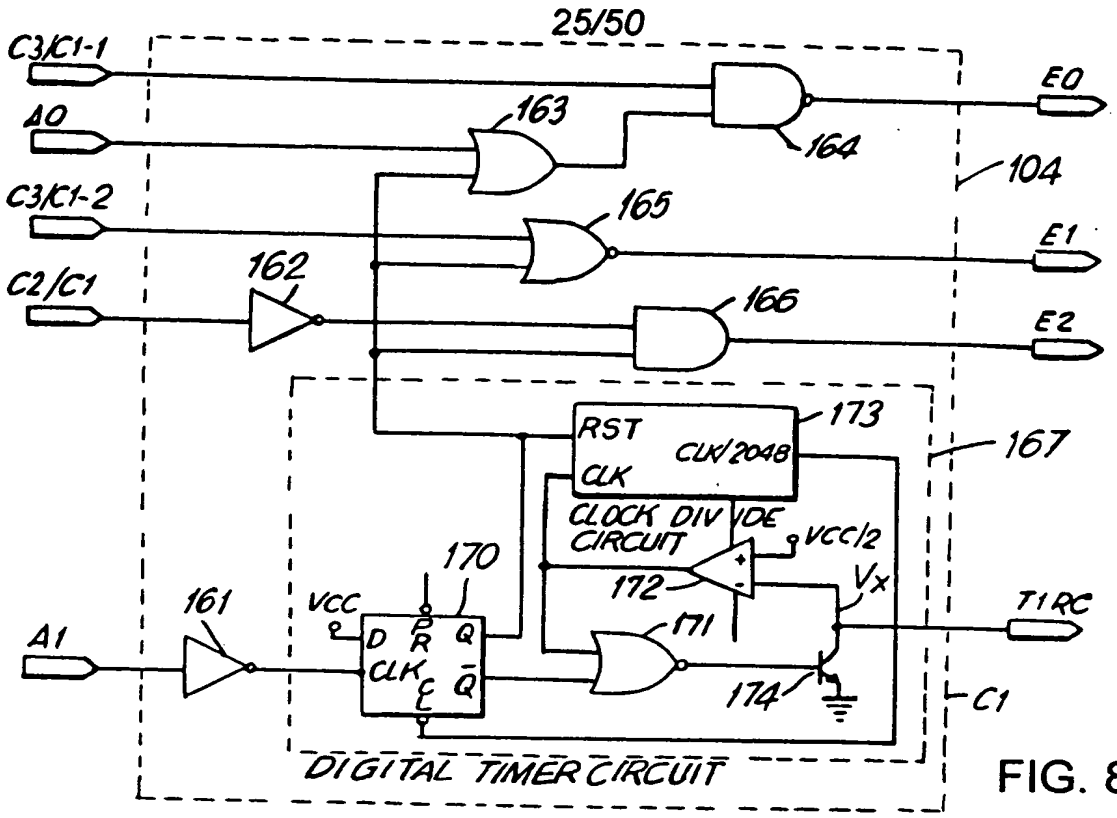

25/50
C3/C1-1
A0
C3/C1-2
C2/C1
A1
E0
E1
E2
T1RC
C1
104
163
164
165
162
166
161
170
171
172
173
174
167
RST
CLK
CLK/2048
CLOCK DIV CIRCUIT
VDE
VCC/2
Vx
VCC
DIGITAL TIMER CIRCUIT

FIG. 8I

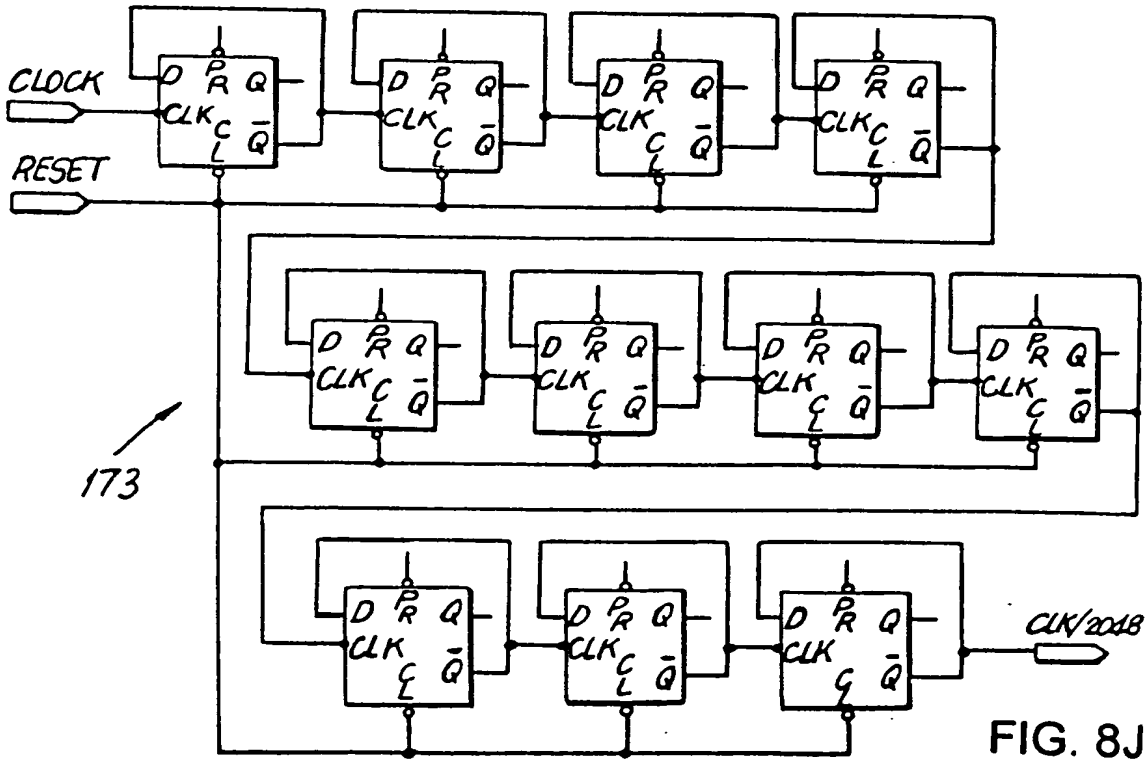

CLOCK
RESET
173
CLK/2048

FIG. 8J

$$E_0 = \overline{(B + A_0)(C_3 / C_2 - 1)}$$
$$E_1 = (C_3 / C_2 - 2) + B$$
$$E_2 = (C_2 / C_1)(T_1)$$

FIG. 8K

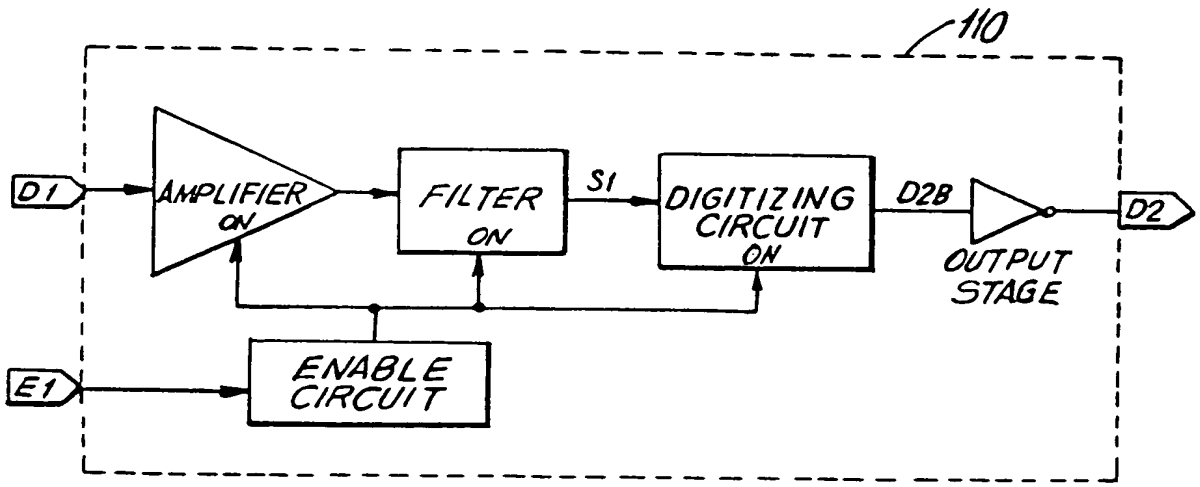


FIG. 8L

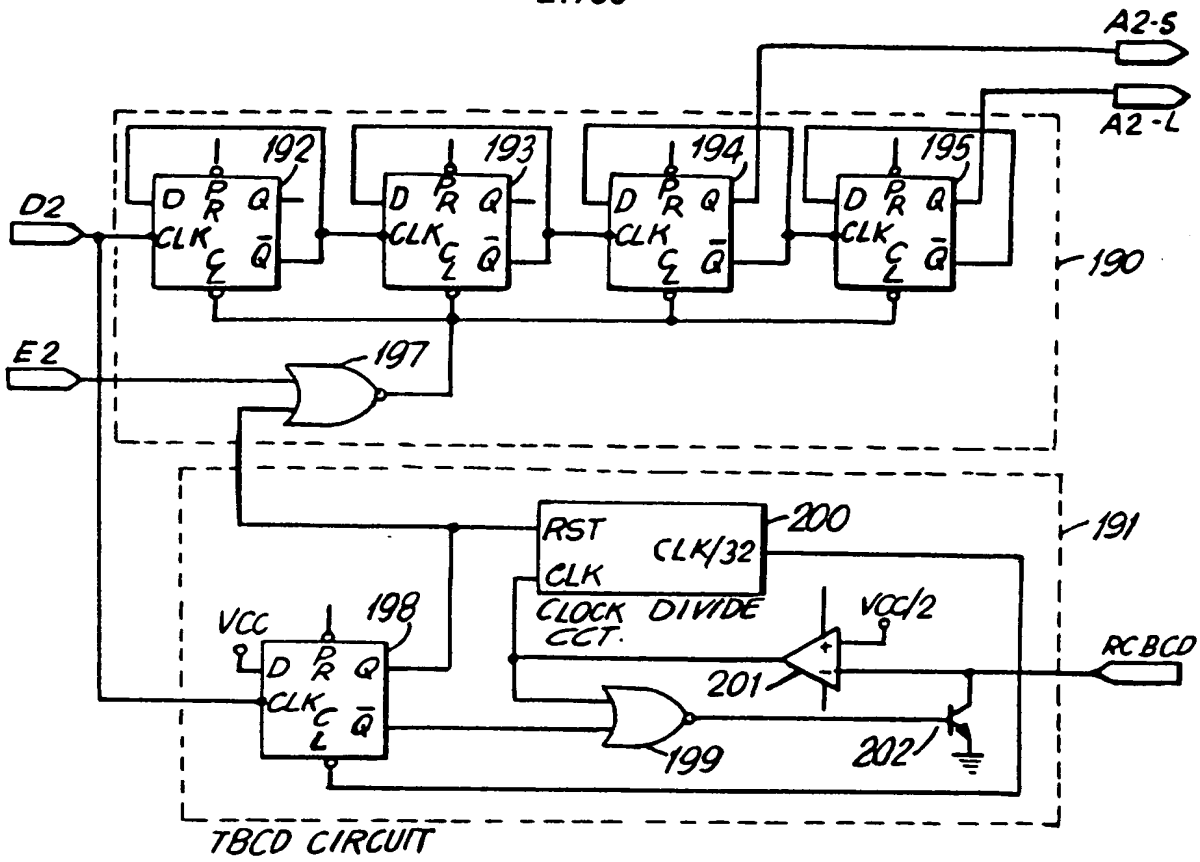

A2-S
A2-L
192
193
194
195
D2
190
E2
197
191
RST
CLK/32
200
CLK
CLOCK DIVIDE CCT.
VCC
198
VCC/2
RC BCD
201
199
202
TBCD CIRCUIT

FIG. 8M

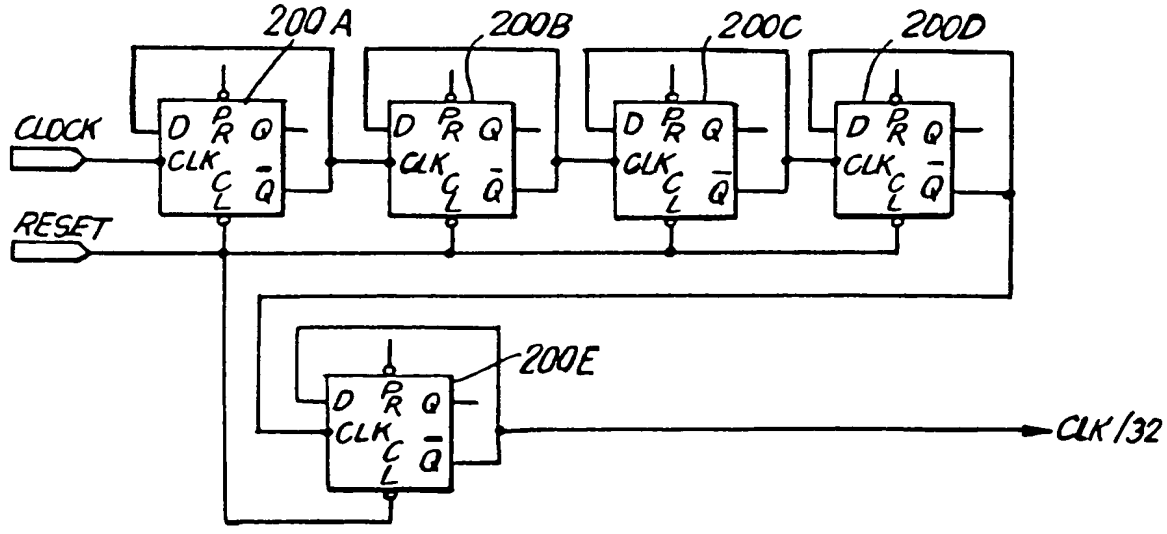

200A
200B
200C
200D
CLOCK
RESET
200E
CLK/32

FIG. 8N

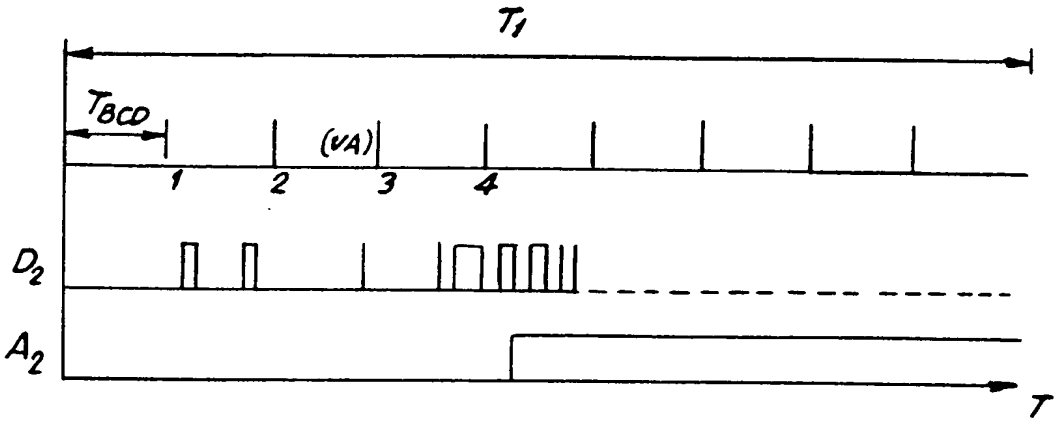


FIG. 8O

R	C_3/C_2-1	C_3/C_2-2	E_3	C_2/C_1
0	X	X	A_{2L}	0
1	0	0	A_{2L}	0
1	0	1	A_{2S}	0
X	1	1	X	1
	X = DON'T CARE			

FIG. 8Q

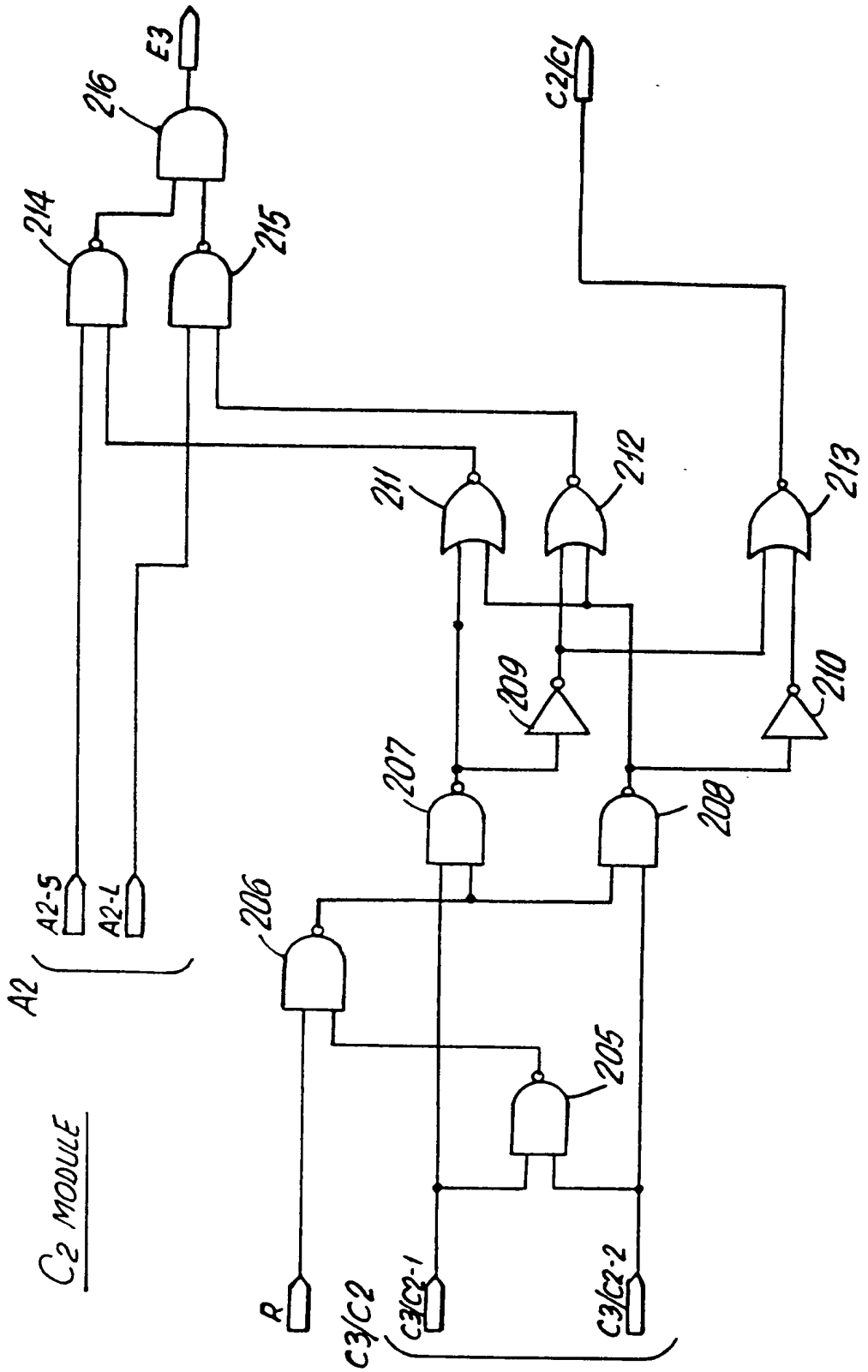

C2 MODULE
A2
A2-5
A2-L
E3
216
214
215
C2/C1
211
212
213
209
210
207
208
206
205
R
C3/C2
C3/C2-1
C3/C2-2

FIG. 8P

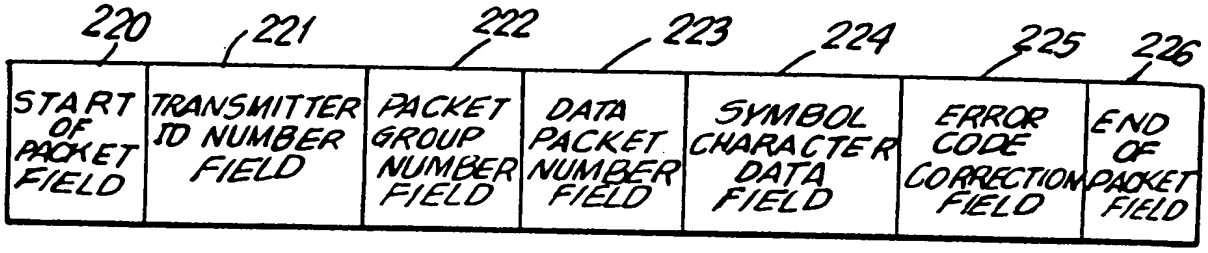

220
221
222
223
224
225
226
START OF PACKET FIELD
TRANSMITTER ID NUMBER FIELD
PACKET GROUP NUMBER FIELD
DATA PACKET NUMBER FIELD
SYMBOL CHARACTER DATA FIELD
ERROR CODE CORRECTION FIELD
END OF PACKET FIELD

FIG. 8R

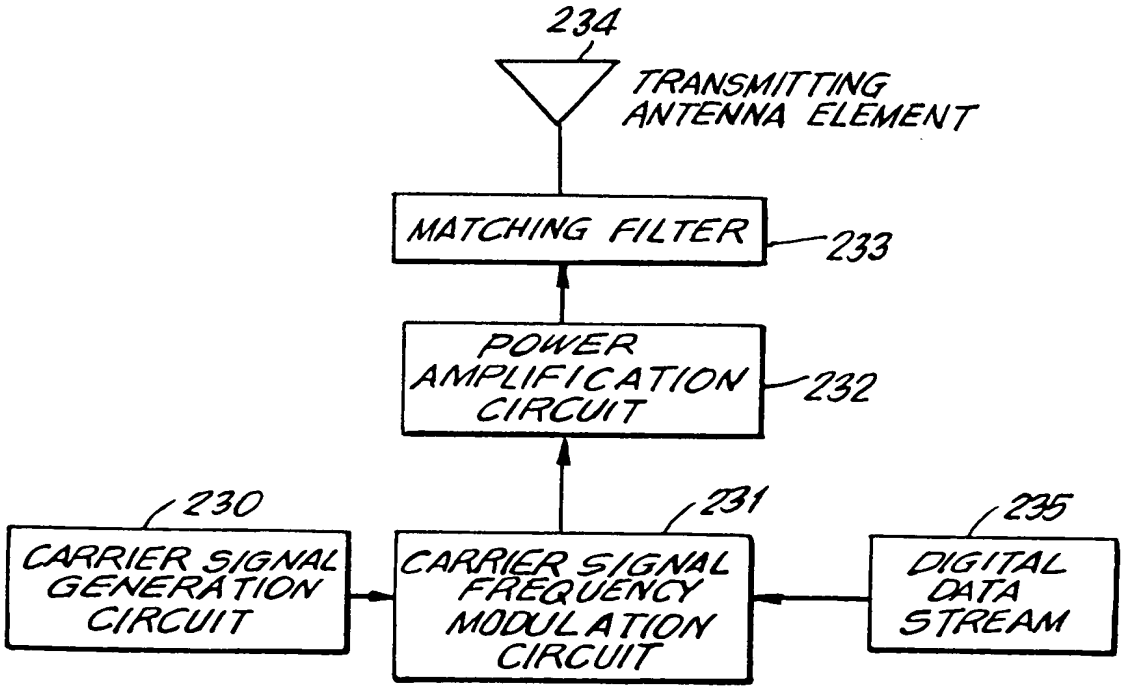

234
TRANSMITTING ANTENNA ELEMENT
MATCHING FILTER
233
POWER AMPLIFICATION CIRCUIT
232
230
231
235
CARRIER SIGNAL GENERATION CIRCUIT
CARRIER SIGNAL FREQUENCY MODULATION CIRCUIT
DIGITAL DATA STREAM

FIG. 9

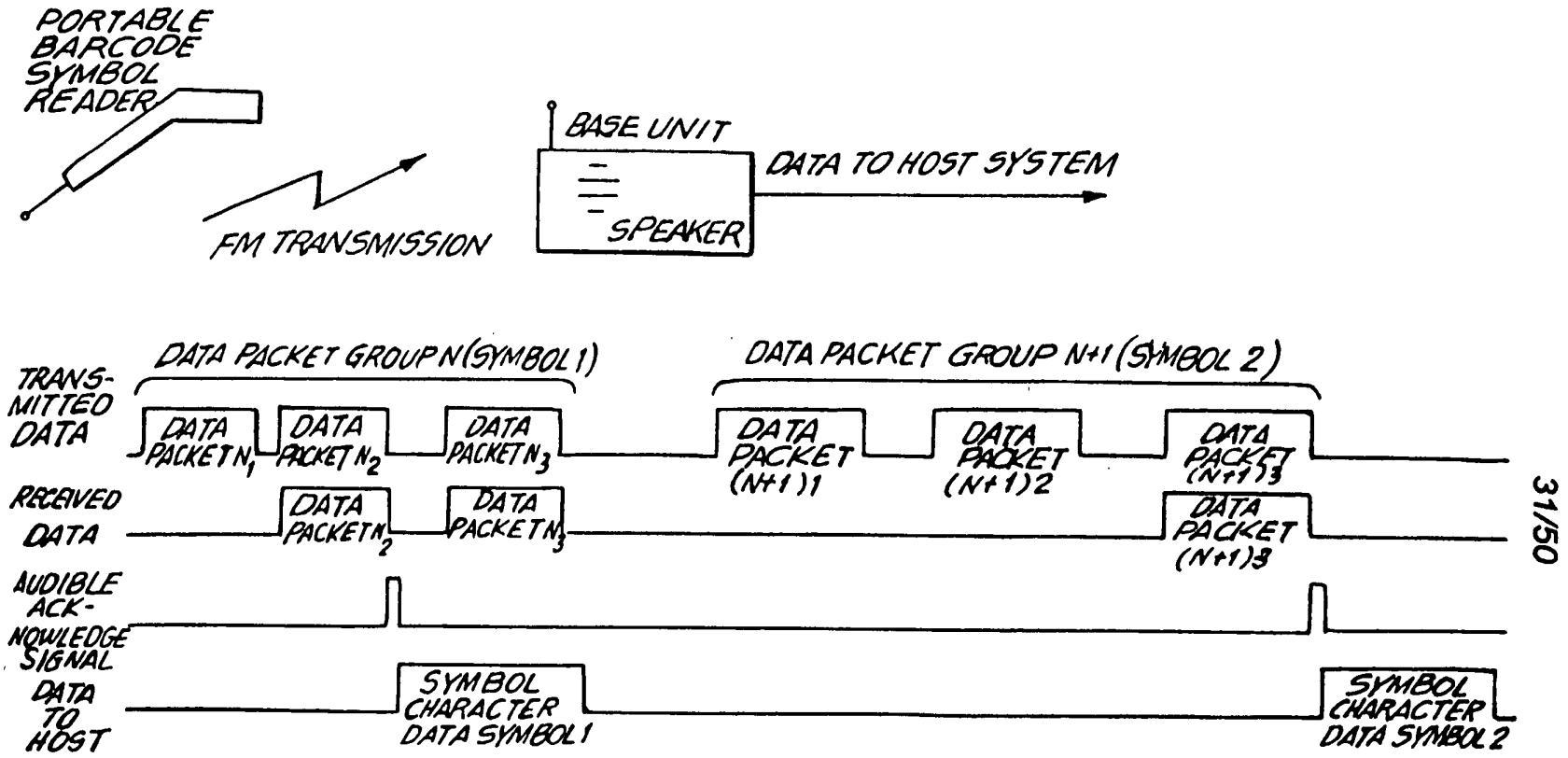

PORTABLE BARCODE SYMBOL READER
FM TRANSMISSION
BASE UNIT
SPEAKER
DATA TO HOST SYSTEM
DATA PACKET GROUP N (SYMBOL 1)
DATA PACKET GROUP N+1 (SYMBOL 2)
TRANS-MITTED DATA
DATA PACKET N1
DATA PACKET N2
DATA PACKET N3
DATA PACKET (N+1)1
DATA PACKET (N+1)2
DATA PACKET (N+1)3
RECEIVED DATA
DATA PACKET N2
DATA PACKET N3
DATA PACKET (N+1)3
AUDIBLE ACK-NOWLEDGE SIGNAL
DATA TO HOST
SYMBOL CHARACTER DATA SYMBOL 1
SYMBOL CHARACTER DATA SYMBOL 2

FIG. 10

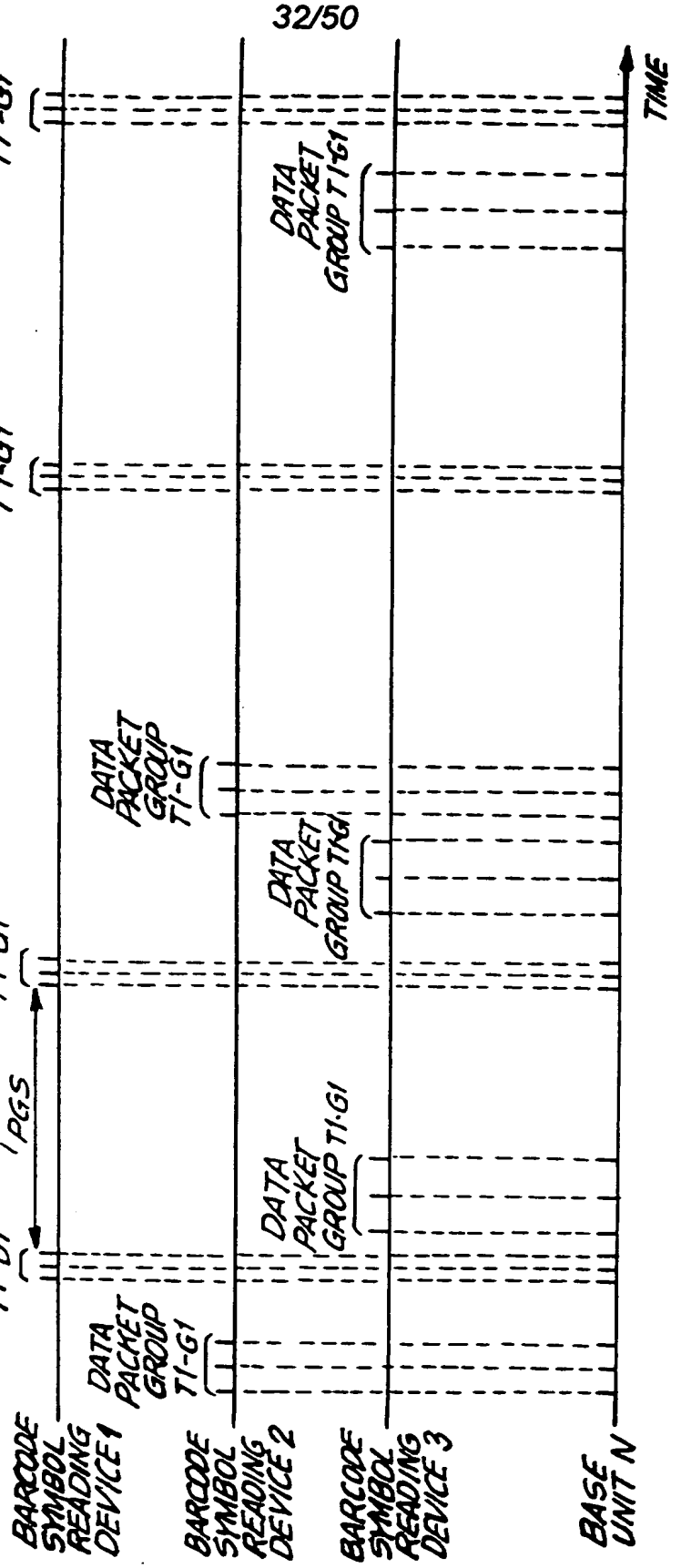
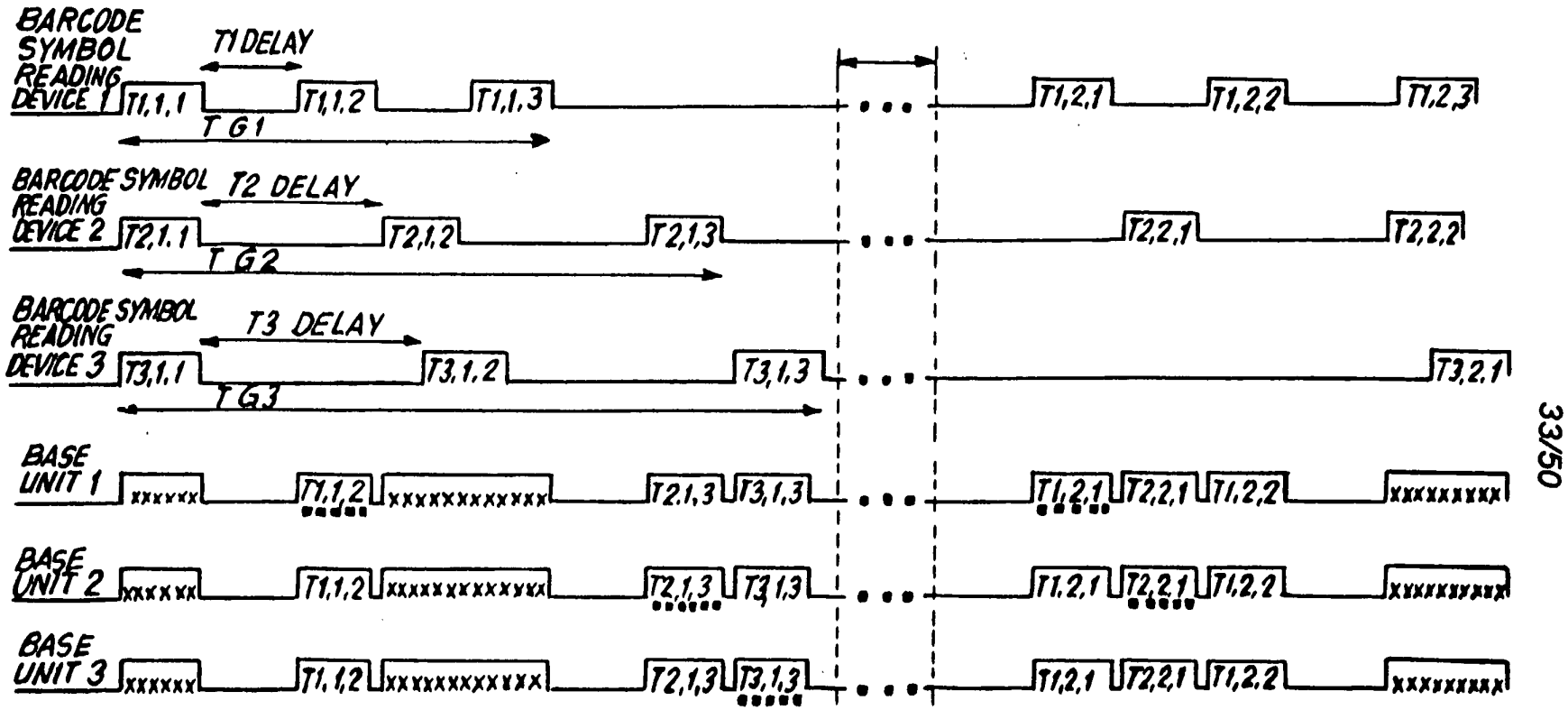

BARCODE SYMBOL READING DEVICE 1
BARCODE SYMBOL READING DEVICE 2
BARCODE SYMBOL READING DEVICE 3
BASE UNIT N
DATA PACKET GROUP T1-G1
DATA PACKET GROUP T1-G1
DATA PACKET GROUP T1-G1
DATA PACKET GROUP T1-G1
DATA PACKET GROUP T1-G1
DATA PACKET GROUP T1-G1
DATA PACKET GROUP T1-G1
T_{PGS}
TIME

FIG. 11



33/50

FIG. 12

DATA PACKET NOTATION:
TRANSMITTER #, GROUP #, TRANSMITTERS #
xxx DENOTES INTERFERENCE FROM MULTIPLE TRANSMITTERS
..... DENOTES DATA THAT WILL PRODUCE ACKNOWLEDGE

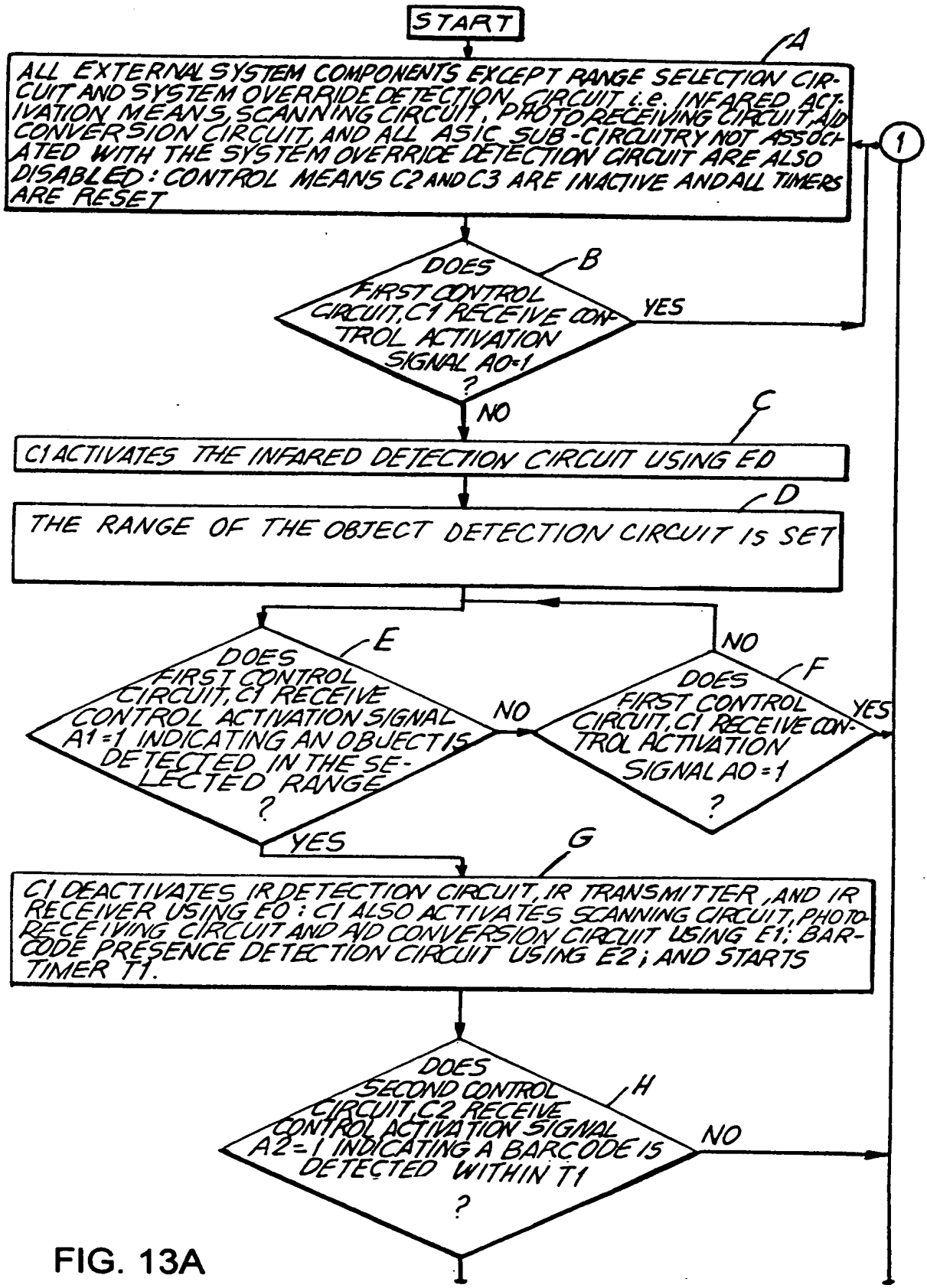

START
A
ALL EXTERNAL SYSTEM COMPONENTS EXCEPT RANGE SELECTION CIRCUIT AND SYSTEM OVERRIDE DETECTION CIRCUIT i.e. INFARED ACTIVATION MEANS, SCANNING CIRCUIT, PHOTO RECEIVING CIRCUIT, AID CONVERSION CIRCUIT, AND ALL ASIC SUB-CIRCUITRY NOT ASSOCIATED WITH THE SYSTEM OVERRIDE DETECTION CIRCUIT ARE ALSO DISABLED: CONTROL MEANS C2 AND C3 ARE INACTIVE AND ALL TIMERS ARE RESET
1
B
DOES FIRST CONTROL CIRCUIT, C1 RECEIVE CONTROL ACTIVATION SIGNAL A0=1 ?
YES
NO
C
C1 ACTIVATES THE INFARED DETECTION CIRCUIT USING E0
D
THE RANGE OF THE OBJECT DETECTION CIRCUIT IS SET
E
DOES FIRST CONTROL CIRCUIT, C1 RECEIVE CONTROL ACTIVATION SIGNAL A1=1 INDICATING AN OBUECT IS DETECTED IN THE SELECTED RANGE ?
NO
NO
F
DOES FIRST CONTROL CIRCUIT, C1 RECEIVE CONTROL ACTIVATION SIGNAL A0=1 ?
YES
YES
G
C1 DEACTIVATES IR DETECTION CIRCUIT, IR TRANSMITTER, AND IR RECEIVER USING E0; C1 ALSO ACTIVATES SCANNING CIRCUIT, PHOTO-RECEIVING CIRCUIT AND AID CONVERSION CIRCUIT USING E1; BAR-CODE PRESENCE DETECTION CIRCUIT USING E2; AND STARTS TIMER T1.
H
DOES SECOND CONTROL CIRCUIT C2 RECEIVE CONTROL ACTIVATION SIGNAL A2=1 INDICATING A BARCODE IS DETECTED WITHIN T1 ?
NO

FIG. 13A

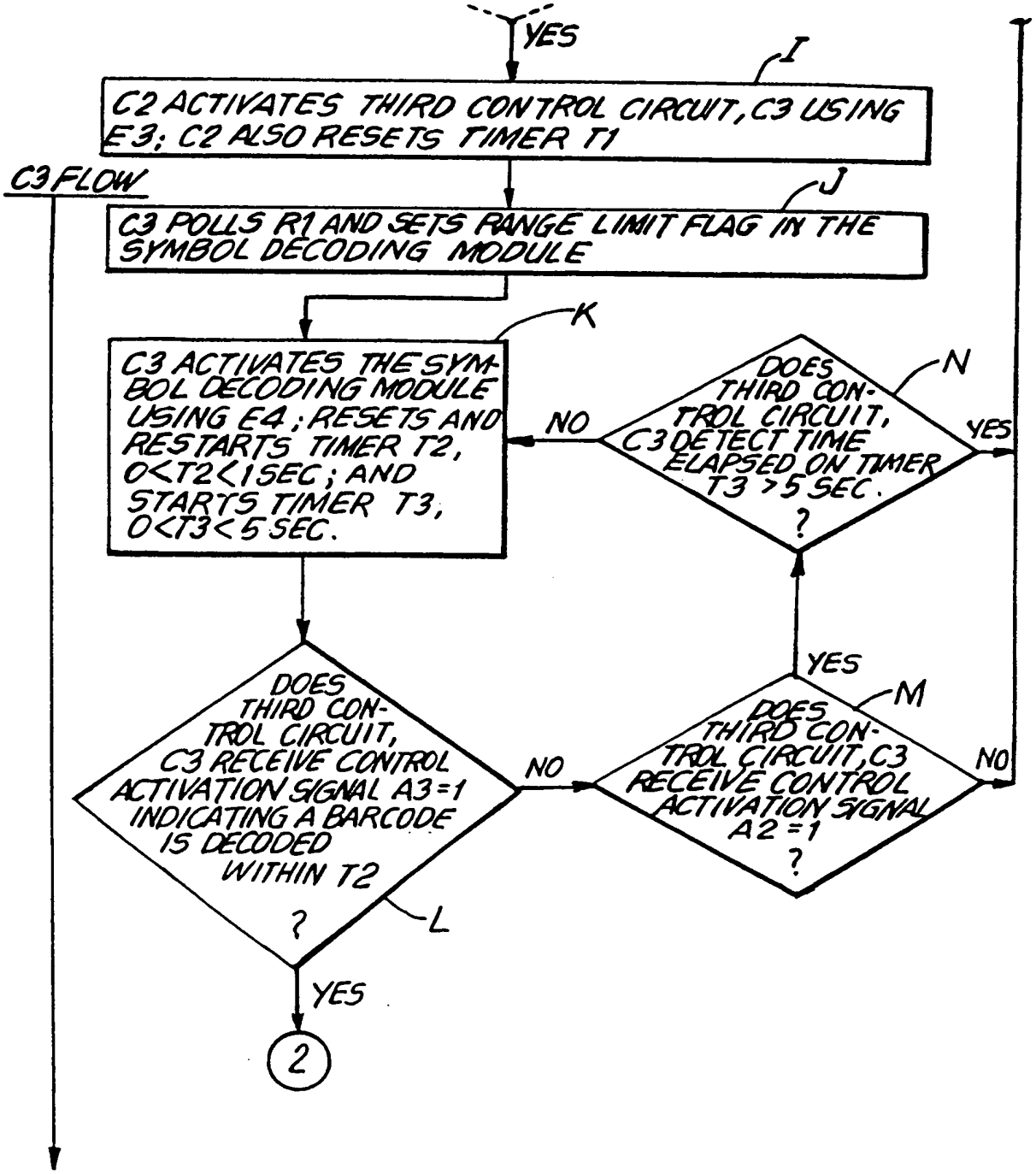

YES
I
C2 ACTIVATES THIRD CONTROL CIRCUIT, C3 USING E3; C2 ALSO RESETS TIMER T1
C3 FLOW
J
C3 POLLS R1 AND SETS RANGE LIMIT FLAG IN THE SYMBOL DECODING MODULE
K
C3 ACTIVATES THE SYMBOL DECODING MODULE USING E4; RESETS AND RESTARTS TIMER T2, 0<T2<1SEC; AND STARTS TIMER T3, 0<T3<5 SEC.
N
DOES THIRD CONTROL CIRCUIT, C3 DETECT TIME ELAPSED ON TIMER T3 >5 SEC. ?
NO
YES
M
DOES THIRD CONTROL CIRCUIT, C3 RECEIVE CONTROL ACTIVATION SIGNAL A2 =1 ?
YES
NO
DOES THIRD CONTROL CIRCUIT, C3 RECEIVE CONTROL ACTIVATION SIGNAL A3=1 INDICATING A BARCODE IS DECODED WITHIN T2 ?
L
NO
YES
2

FIG. 13AA

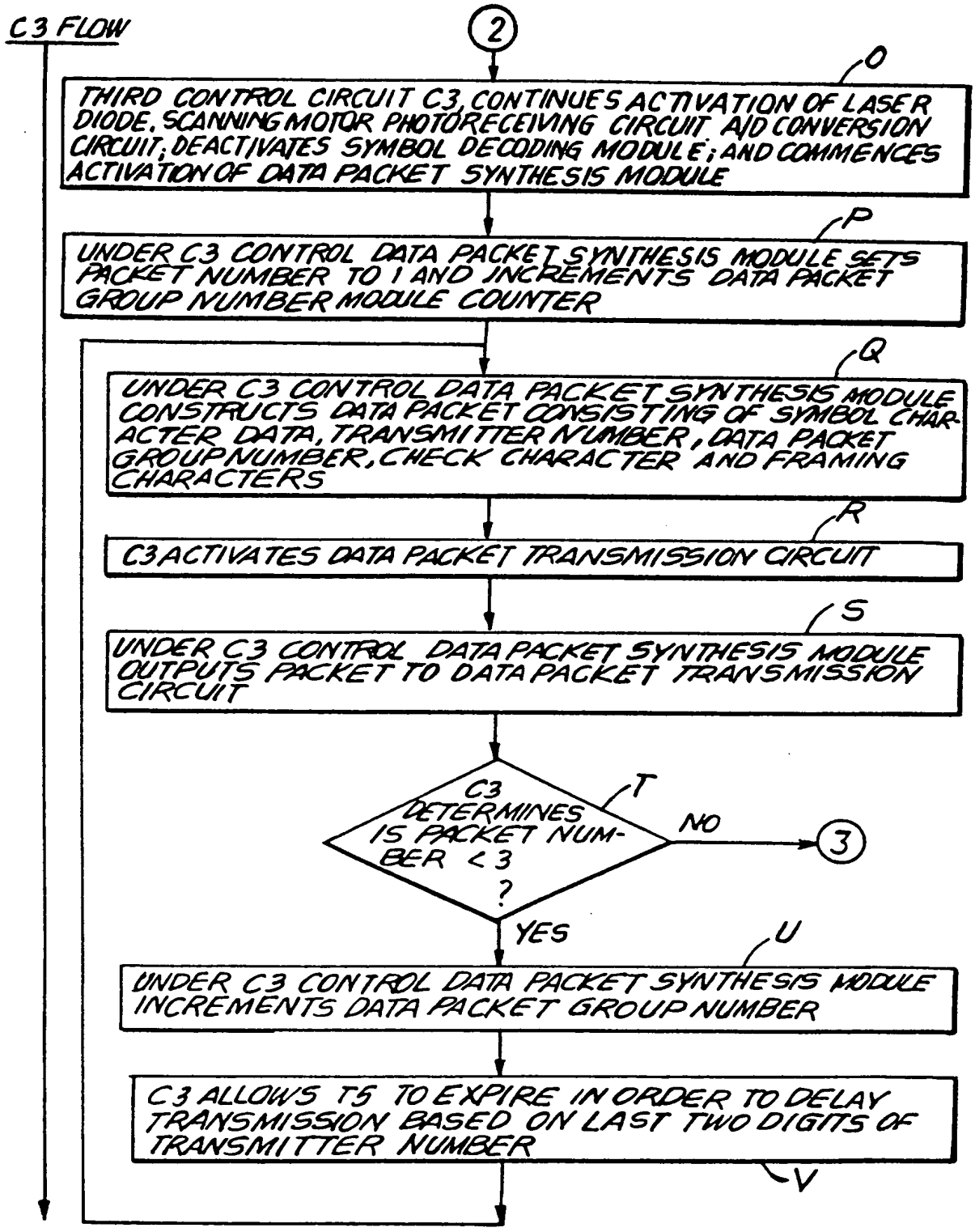

C3 FLOW
2
O
THIRD CONTROL CIRCUIT C3, CONTINUES ACTIVATION OF LASER DIODE, SCANNING MOTOR PHOTORECEIVING CIRCUIT A/D CONVERSION CIRCUIT; DEACTIVATES SYMBOL DECODING MODULE; AND COMMENCES ACTIVATION OF DATA PACKET SYNTHESIS MODULE
P
UNDER C3 CONTROL DATA PACKET SYNTHESIS MODULE SETS PACKET NUMBER TO 1 AND INCREMENTS DATA PACKET GROUP NUMBER MODULE COUNTER
Q
UNDER C3 CONTROL DATA PACKET SYNTHESIS MODULE CONSTRUCTS DATA PACKET CONSISTING OF SYMBOL CHARACTER DATA, TRANSMITTER NUMBER, DATA PACKET GROUP NUMBER, CHECK CHARACTER AND FRAMING CHARACTERS
R
C3 ACTIVATES DATA PACKET TRANSMISSION CIRCUIT
S
UNDER C3 CONTROL DATA PACKET SYNTHESIS MODULE OUTPUTS PACKET TO DATA PACKET TRANSMISSION CIRCUIT
T
C3 DETERMINES IS PACKET NUMBER < 3 ?
NO
3
YES
U
UNDER C3 CONTROL DATA PACKET SYNTHESIS MODULE INCREMENTS DATA PACKET GROUP NUMBER
C3 ALLOWS T5 TO EXPIRE IN ORDER TO DELAY TRANSMISSION BASED ON LAST TWO DIGITS OF TRANSMITTER NUMBER
V

FIG. 13B

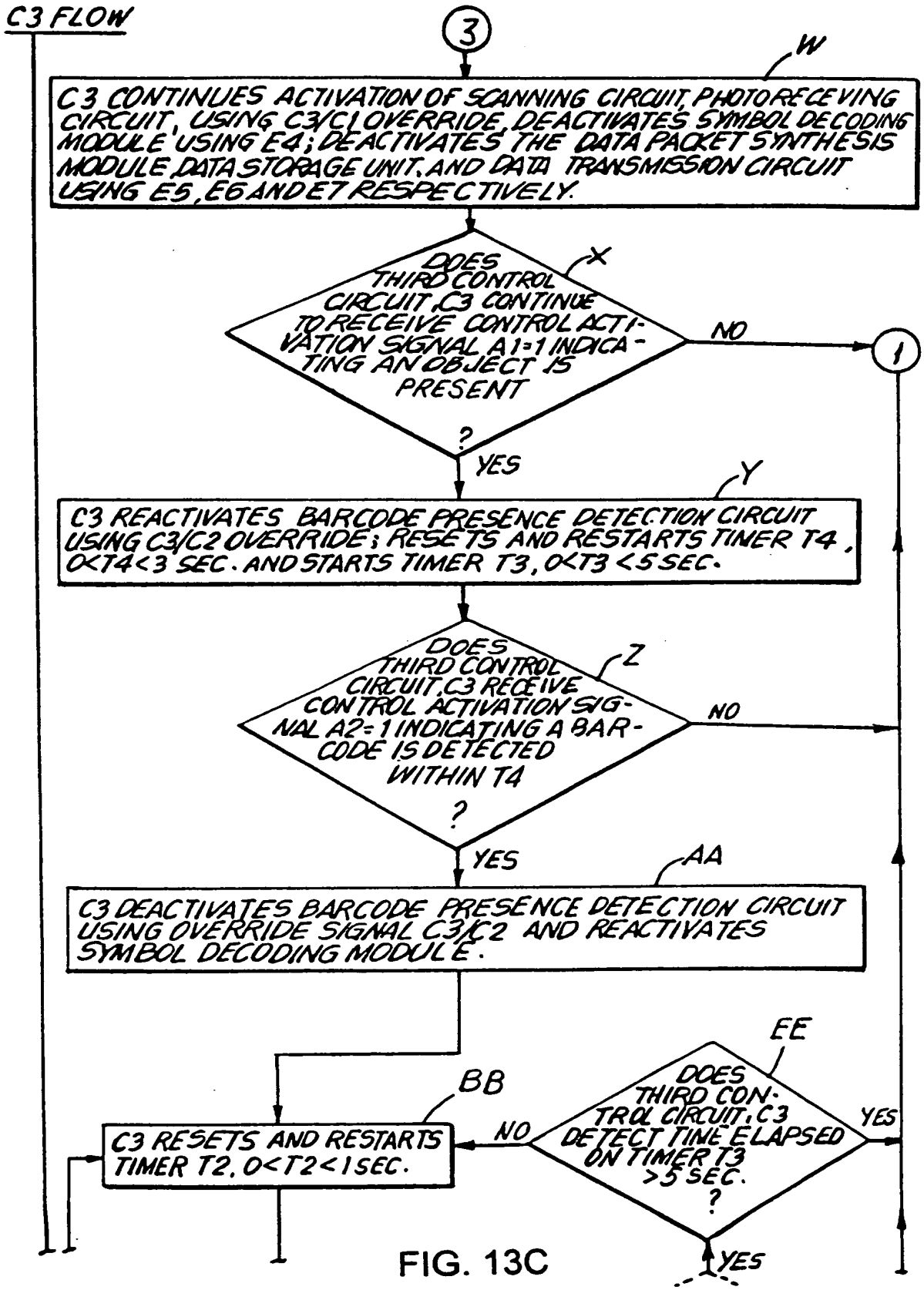

C3 FLOW
3
W
C3 CONTINUES ACTIVATION OF SCANNING CIRCUIT, PHOTORECEVING CIRCUIT, USING C3/C1 OVERRIDE, DEACTIVATES SYMBOL DECODING MODULE USING E4; DEACTIVATES THE DATA PACKET SYNTHESIS MODULE, DATA STORAGE UNIT, AND DATA TRANSMISSION CIRCUIT USING E5, E6 AND E7 RESPECTIVELY.
X
DOES THIRD CONTROL CIRCUIT, C3 CONTINUE TO RECEIVE CONTROL ACTIVATION SIGNAL A1=1 INDICATING AN OBJECT IS PRESENT ?
NO
1
YES
Y
C3 REACTIVATES BARCODE PRESENCE DETECTION CIRCUIT USING C3/C2 OVERRIDE; RESETS AND RESTARTS TIMER T4, 0<T4<3 SEC. AND STARTS TIMER T3, 0<T3<5 SEC.
Z
DOES THIRD CONTROL CIRCUIT, C3 RECEIVE CONTROL ACTIVATION SIGNAL A2=1 INDICATING A BARCODE IS DETECTED WITHIN T4 ?
NO
YES
AA
C3 DEACTIVATES BARCODE PRESENCE DETECTION CIRCUIT USING OVERRIDE SIGNAL C3/C2 AND REACTIVATES SYMBOL DECODING MODULE.
EE
DOES THIRD CONTROL CIRCUIT, C3 DETECT TIME ELAPSED ON TIMER T3 >5 SEC. ?
YES
NO
BB
C3 RESETS AND RESTARTS TIMER T2, 0<T2<1 SEC.
YES

FIG. 13C

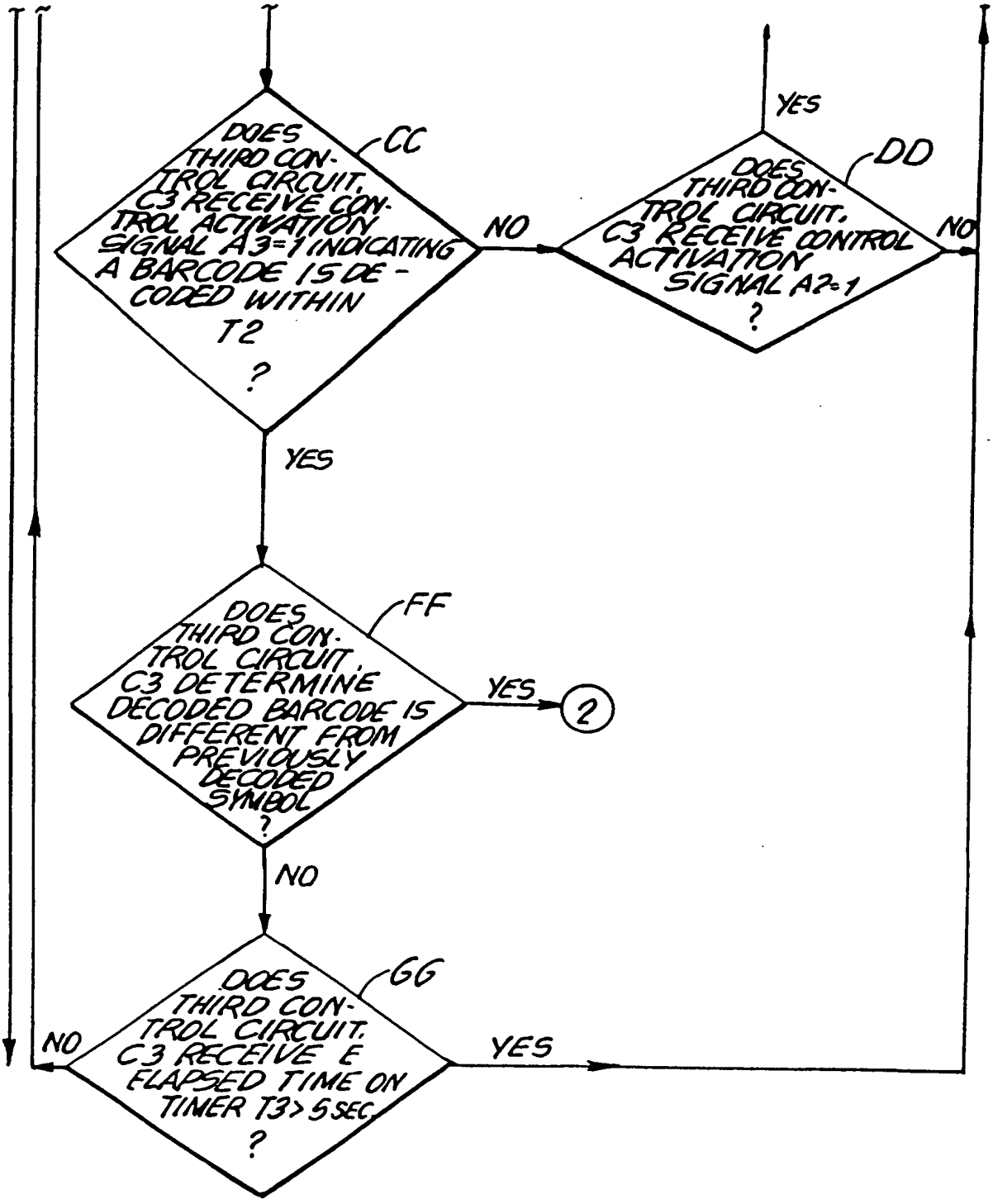

DOES THIRD CONTROL CIRCUIT C3 RECEIVE CONTROL ACTIVATION SIGNAL A3=1 INDICATING A BARCODE IS DECODED WITHIN T2 ?
CC
NO
YES
DOES THIRD CONTROL CIRCUIT C3 RECEIVE CONTROL ACTIVATION SIGNAL A2=1 ?
DD
NO
YES
DOES THIRD CONTROL CIRCUIT C3 DETERMINE DECODED BARCODE IS DIFFERENT FROM PREVIOUSLY DECODED SYMBOL ?
FF
YES
2
NO
DOES THIRD CONTROL CIRCUIT C3 RECEIVE ELAPSED TIME ON TIMER T3>5 SEC ?
GG
NO
YES

FIG. 13CC

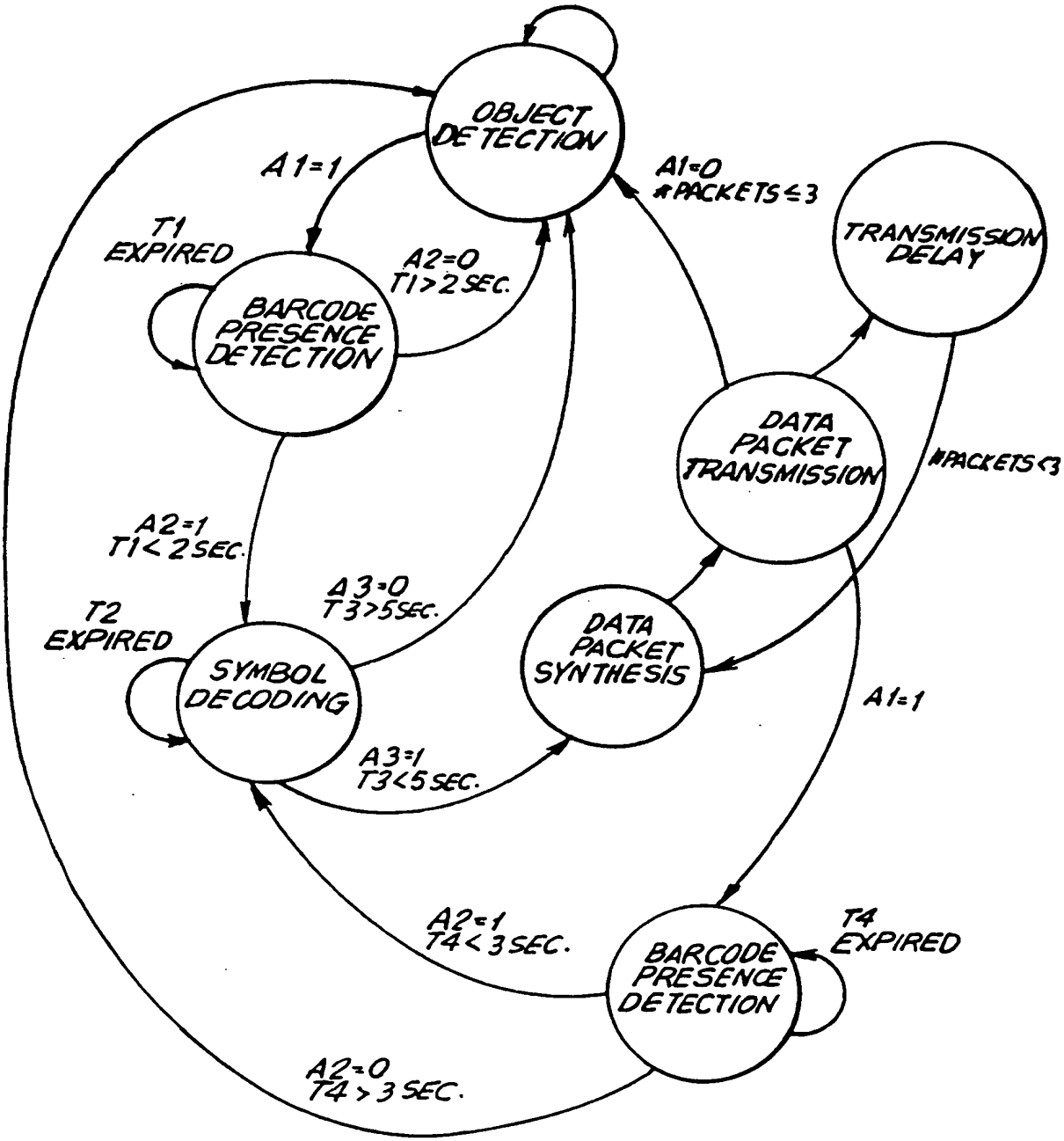

OBJECT DETECTION
A1=1
A1=0
#PACKETS≤3
TRANSMISSION DELAY
T1 EXPIRED
A2=0
T1>2SEC.
BARCODE PRESENCE DETECTION
DATA PACKET TRANSMISSION
#PACKETS<3
A2=1
T1<2SEC.
A3=0
T3>5SEC.
T2 EXPIRED
SYMBOL DECODING
DATA PACKET SYNTHESIS
A1=1
A3=1
T3<5SEC.
A2=1
T4<3SEC.
T4 EXPIRED
BARCODE PRESENCE DETECTION
A2=0
T4>3SEC.

FIG. 14

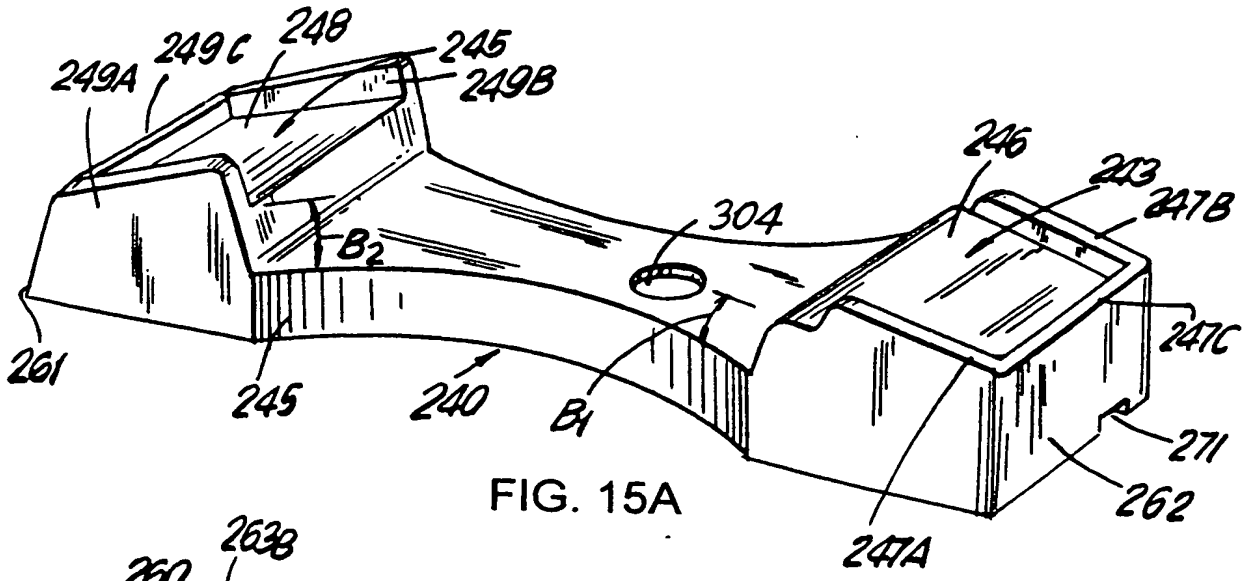


FIG. 15A

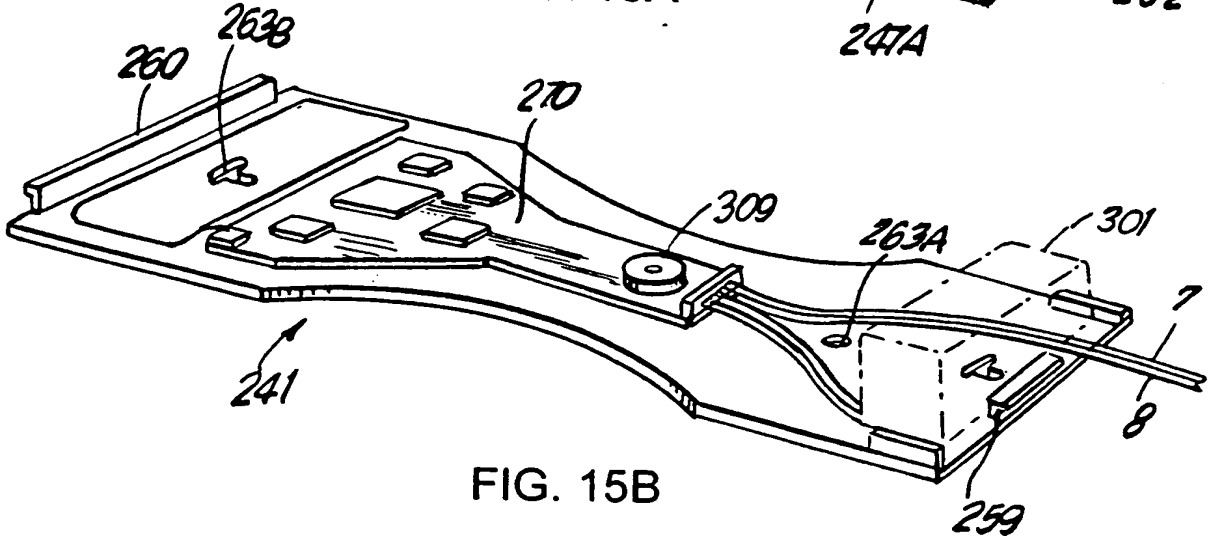


FIG. 15B

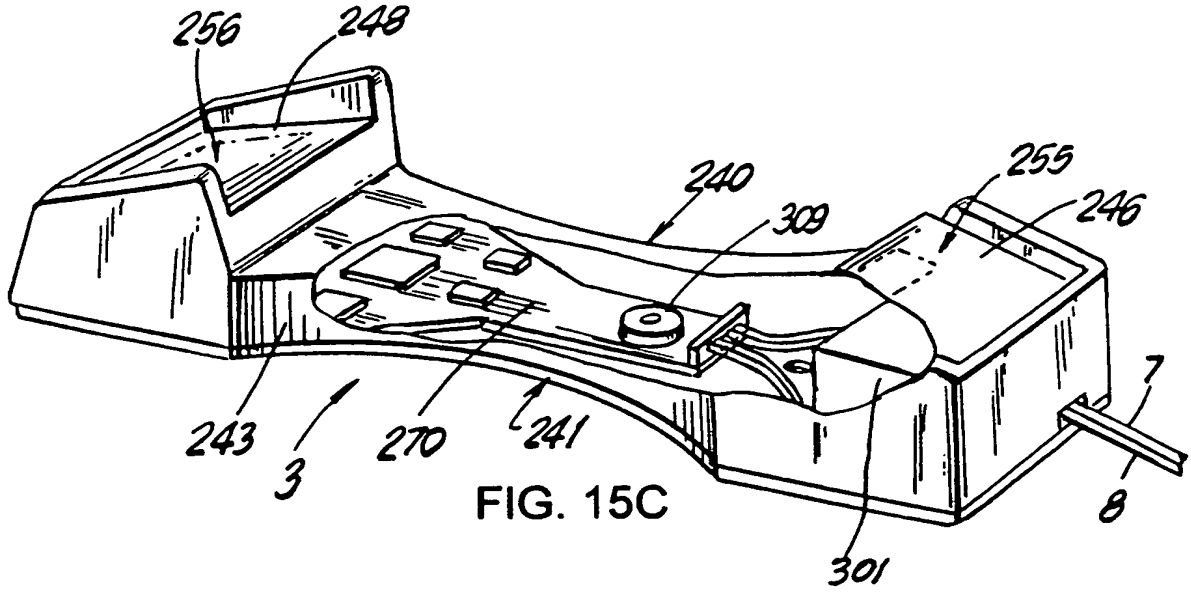


FIG. 15C

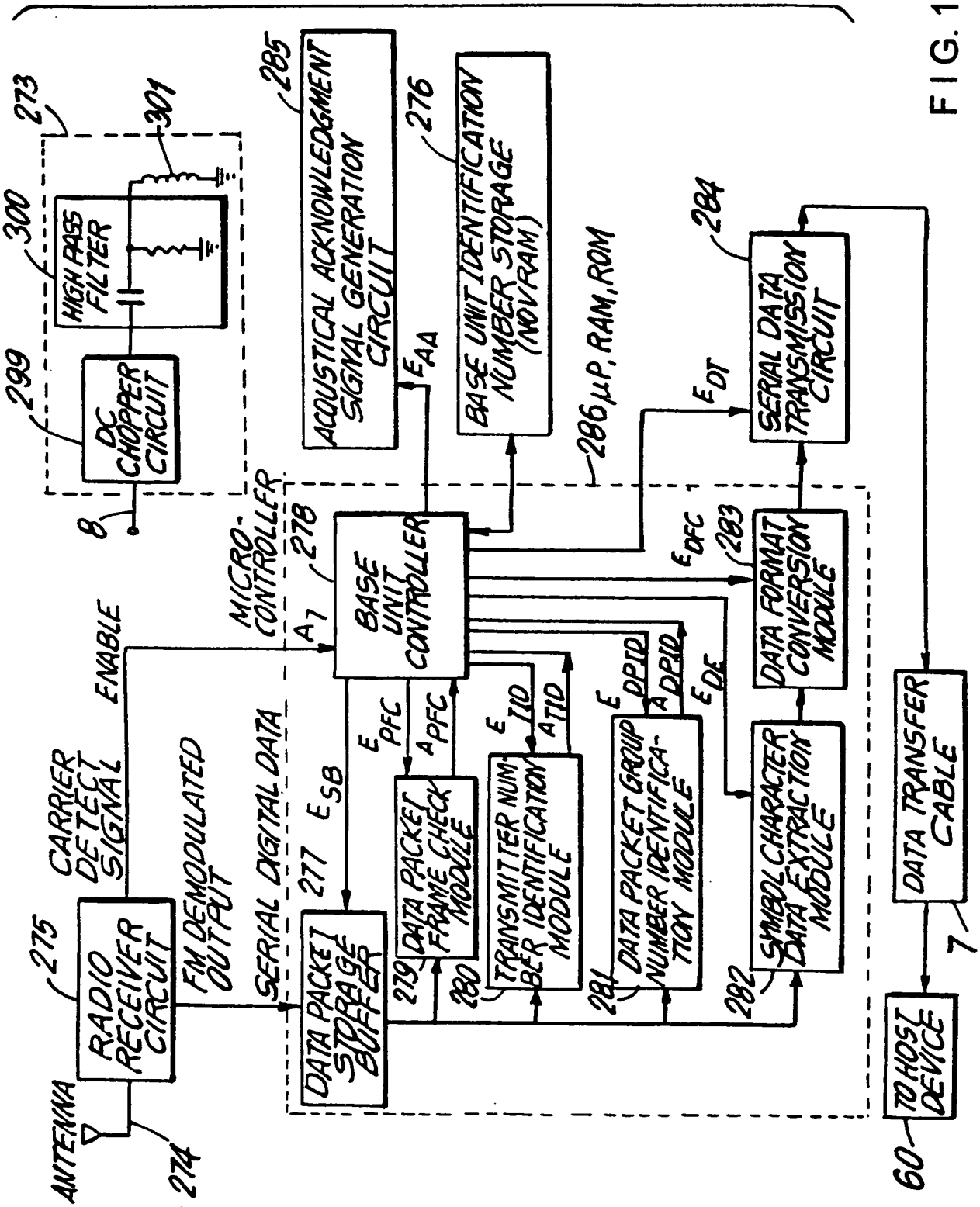

ANTENNA
274
RADIO RECEIVER CIRCUIT
275
CARRIER DETECT SIGNAL
ENABLE
FM DEMODULATED OUTPUT
SERIAL DIGITAL DATA
DATA PACKET BUFFER
277
E_{SB}
DATA PACKET FRAME CHECK MODULE
279
E_{PFC}
A_{PFC}
TRANSMITTER NUMBER IDENTIFICATION MODULE
280
E_{TID}
A_{TID}
DATA PACKET GROUP NUMBER IDENTIFICATION MODULE
281
E_{DPID}
A_{DPID}
SYMBOL CHARACTER DATA EXTRACTION MODULE
282
E_{DE}
DATA FORMAT CONVERSION MODULE
283
E_{DFC}
SERIAL DATA TRANSMISSION CIRCUIT
284
E_{DT}
DATA TRANSFER CABLE
7
TO HOST DEVICE
60
MICRO-CONTROLLER
278
A_1
BASE UNIT CONTROLLER
286 μP, RAM, ROM
BASE UNIT IDENTIFICATION NUMBER STORAGE (NOVRAM)
276
ACOUSTICAL ACKNOWLEDGMENT SIGNAL GENERATION CIRCUIT
285
E_{AA}
8
DC CHOPPER CIRCUIT
299
HIGH PASS FILTER
300
301
273

FIG. 16

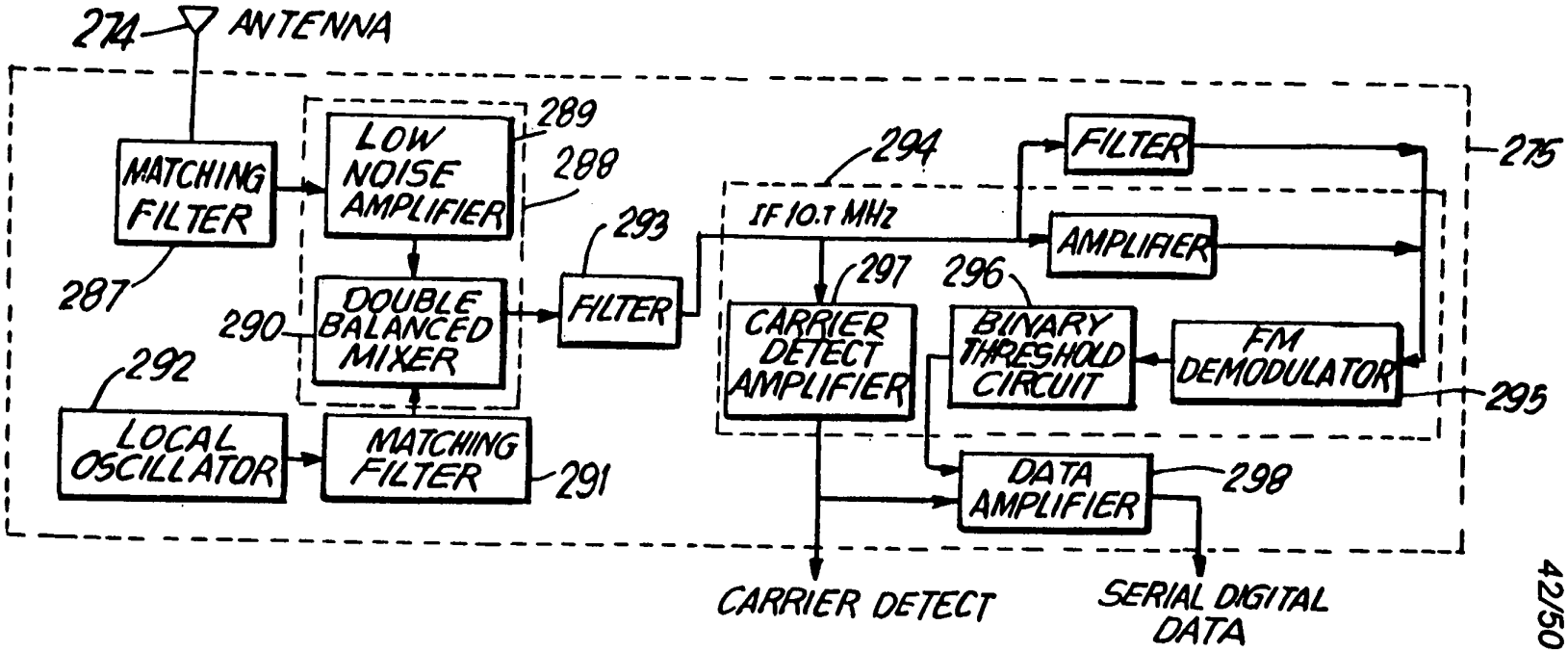


FIG. 16A

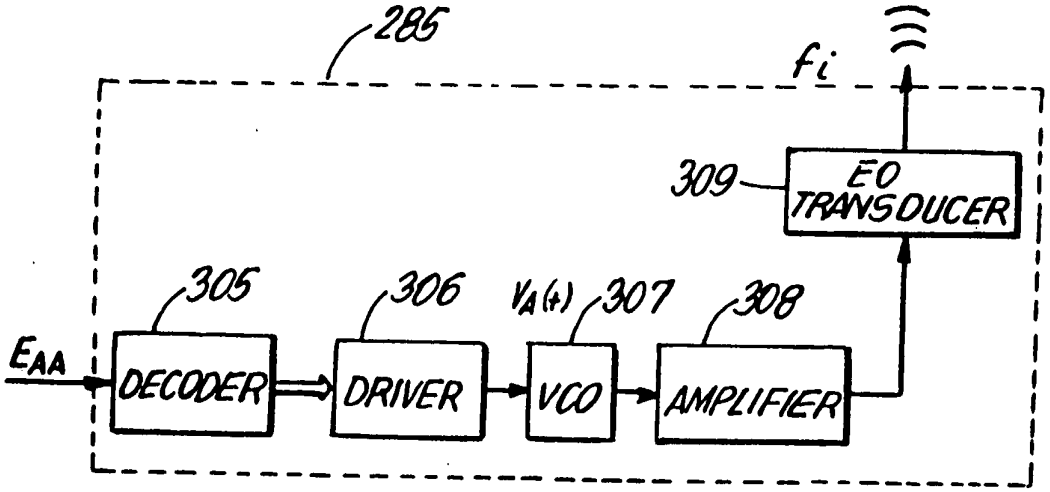


FIG. 16B

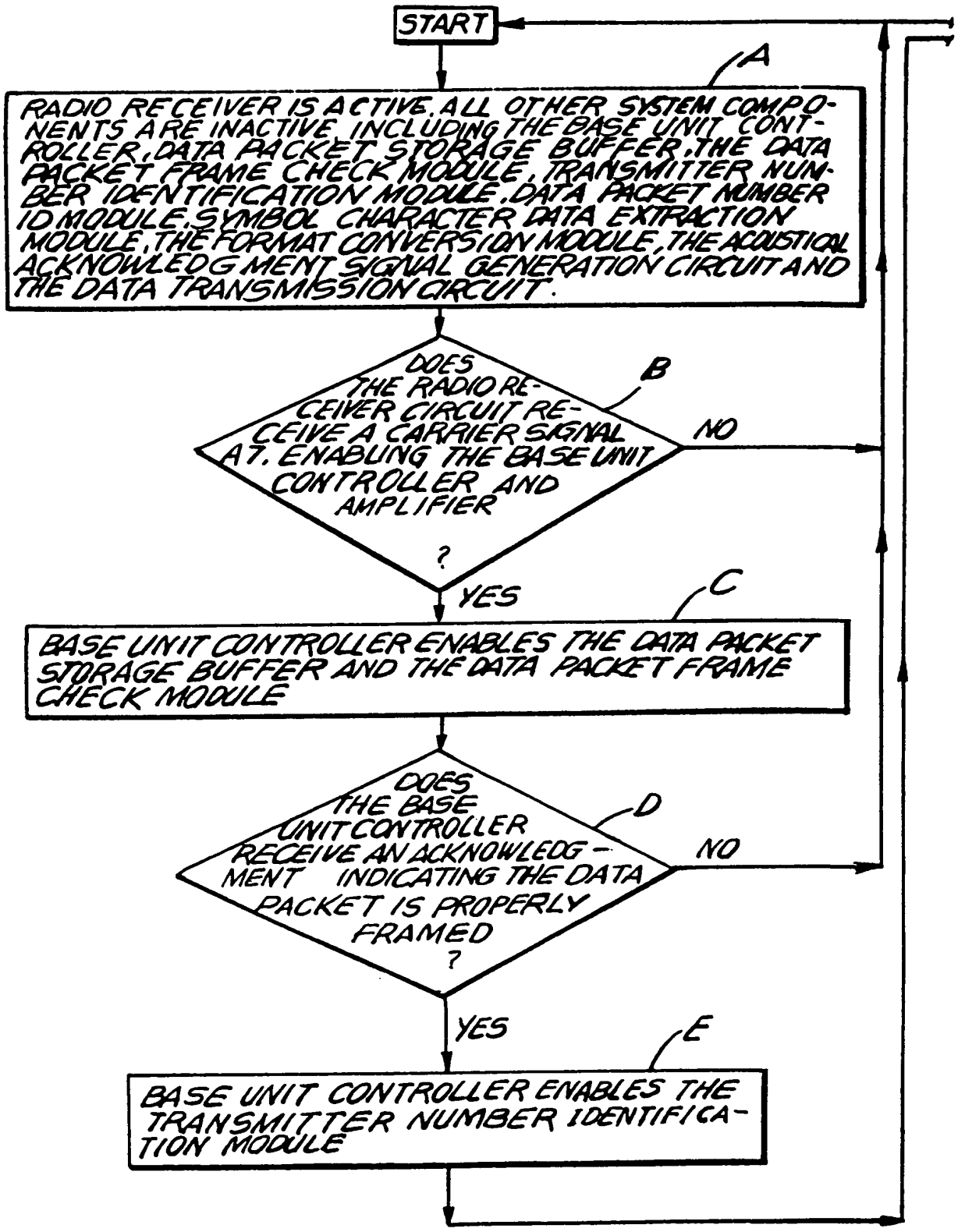

START
A
RADIO RECEIVER IS ACTIVE. ALL OTHER SYSTEM COMPONENTS ARE INACTIVE INCLUDING THE BASE UNIT CONTROLLER, DATA PACKET STORAGE BUFFER, THE DATA PACKET FRAME CHECK MODULE, TRANSMITTER NUMBER IDENTIFICATION MODULE, DATA PACKET NUMBER ID MODULE, SYMBOL CHARACTER DATA EXTRACTION MODULE, THE FORMAT CONVERSION MODULE, THE ACOUSTICAL ACKNOWLEDGMENT SIGNAL GENERATION CIRCUIT AND THE DATA TRANSMISSION CIRCUIT.
B
DOES THE RADIO RECEIVER CIRCUIT RECEIVE A CARRIER SIGNAL AT. ENABLING THE BASE UNIT CONTROLLER AND AMPLIFIER ?
NO
YES
C
BASE UNIT CONTROLLER ENABLES THE DATA PACKET STORAGE BUFFER AND THE DATA PACKET FRAME CHECK MODULE
D
DOES THE BASE UNIT CONTROLLER RECEIVE AN ACKNOWLEDGMENT INDICATING THE DATA PACKET IS PROPERLY FRAMED ?
NO
YES
E
BASE UNIT CONTROLLER ENABLES THE TRANSMITTER NUMBER IDENTIFICATION MODULE

FIG. 17

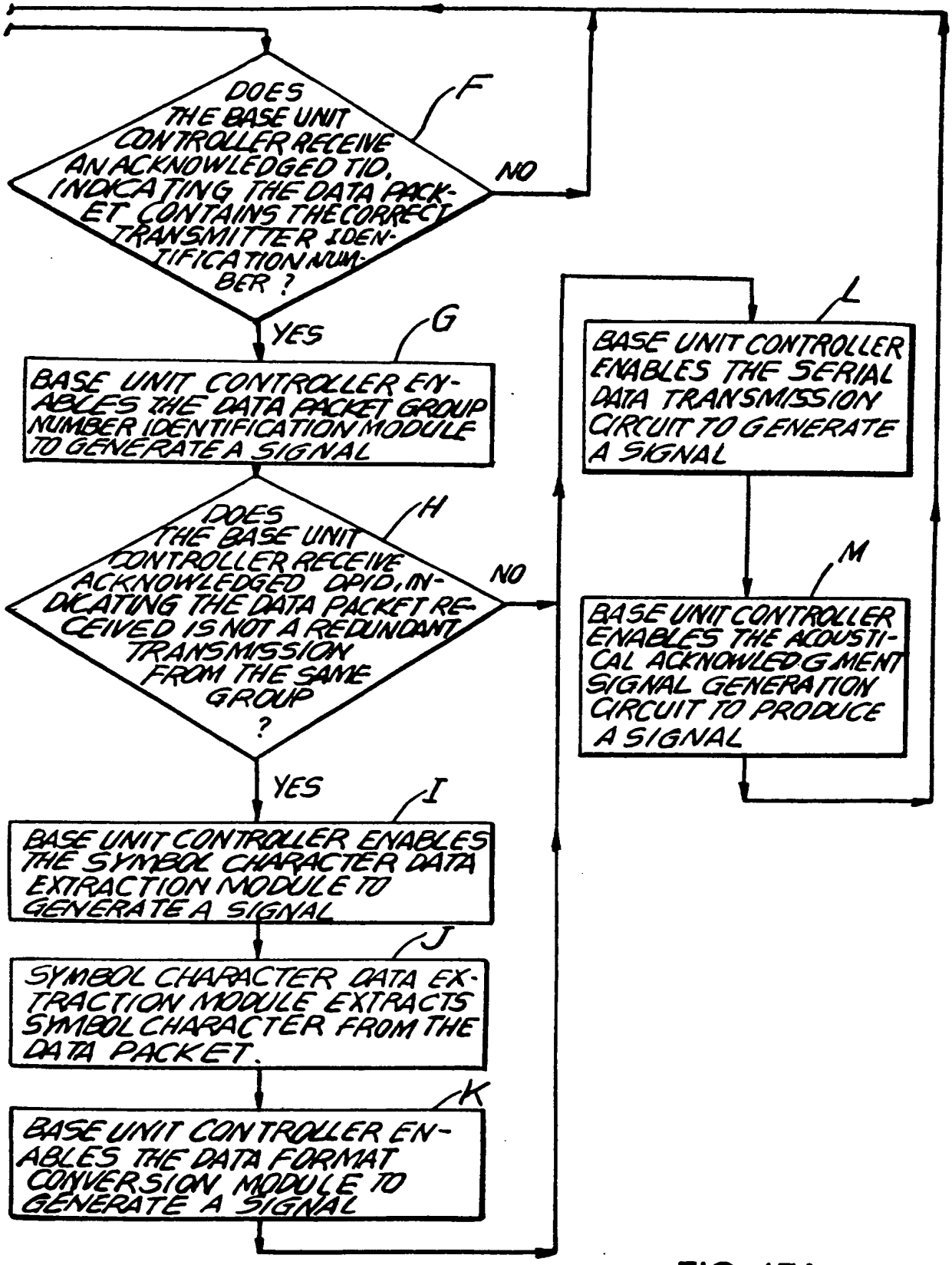

DOES THE BASE UNIT CONTROLLER RECEIVE AN ACKNOWLEDGED TID, INDICATING THE DATA PACKET CONTAINS THE CORRECT TRANSMITTER IDENTIFICATION NUMBER ?
F
NO
YES
G
BASE UNIT CONTROLLER ENABLES THE DATA PACKET GROUP NUMBER IDENTIFICATION MODULE TO GENERATE A SIGNAL
DOES THE BASE UNIT CONTROLLER RECEIVE ACKNOWLEDGED DPID, INDICATING THE DATA PACKET RECEIVED IS NOT A REDUNDANT TRANSMISSION FROM THE SAME GROUP ?
H
NO
YES
I
BASE UNIT CONTROLLER ENABLES THE SYMBOL CHARACTER DATA EXTRACTION MODULE TO GENERATE A SIGNAL
J
SYMBOL CHARACTER DATA EXTRACTION MODULE EXTRACTS SYMBOL CHARACTER FROM THE DATA PACKET.
K
BASE UNIT CONTROLLER ENABLES THE DATA FORMAT CONVERSION MODULE TO GENERATE A SIGNAL
L
BASE UNIT CONTROLLER ENABLES THE SERIAL DATA TRANSMISSION CIRCUIT TO GENERATE A SIGNAL
M
BASE UNIT CONTROLLER ENABLES THE ACOUSTICAL ACKNOWLEDGMENT SIGNAL GENERATION CIRCUIT TO PRODUCE A SIGNAL

FIG. 17A

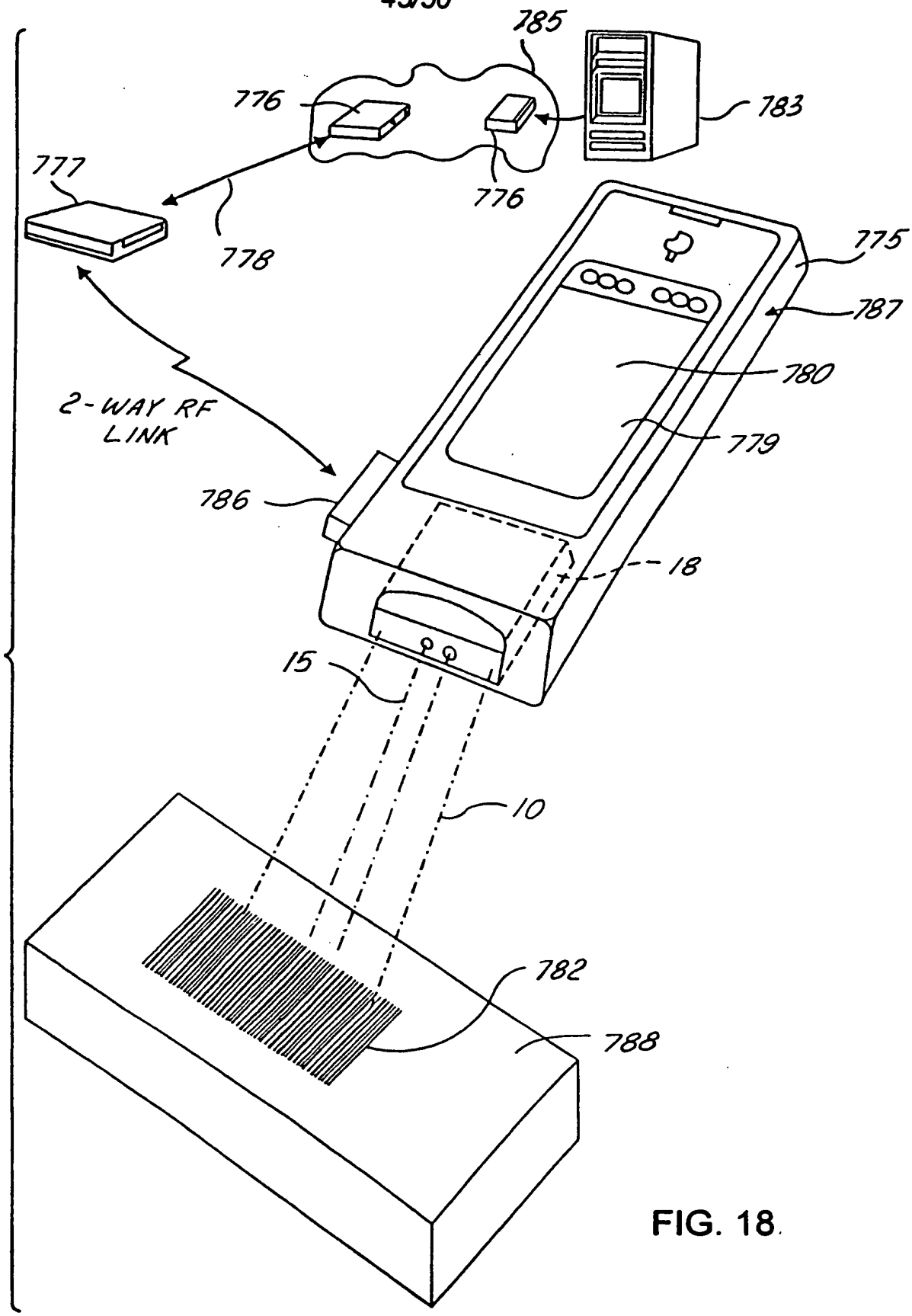

785
776
783
777
776
778
775
787
780
2-WAY RF
LINK
779
786
18
15
10
782
788

FIG. 18.

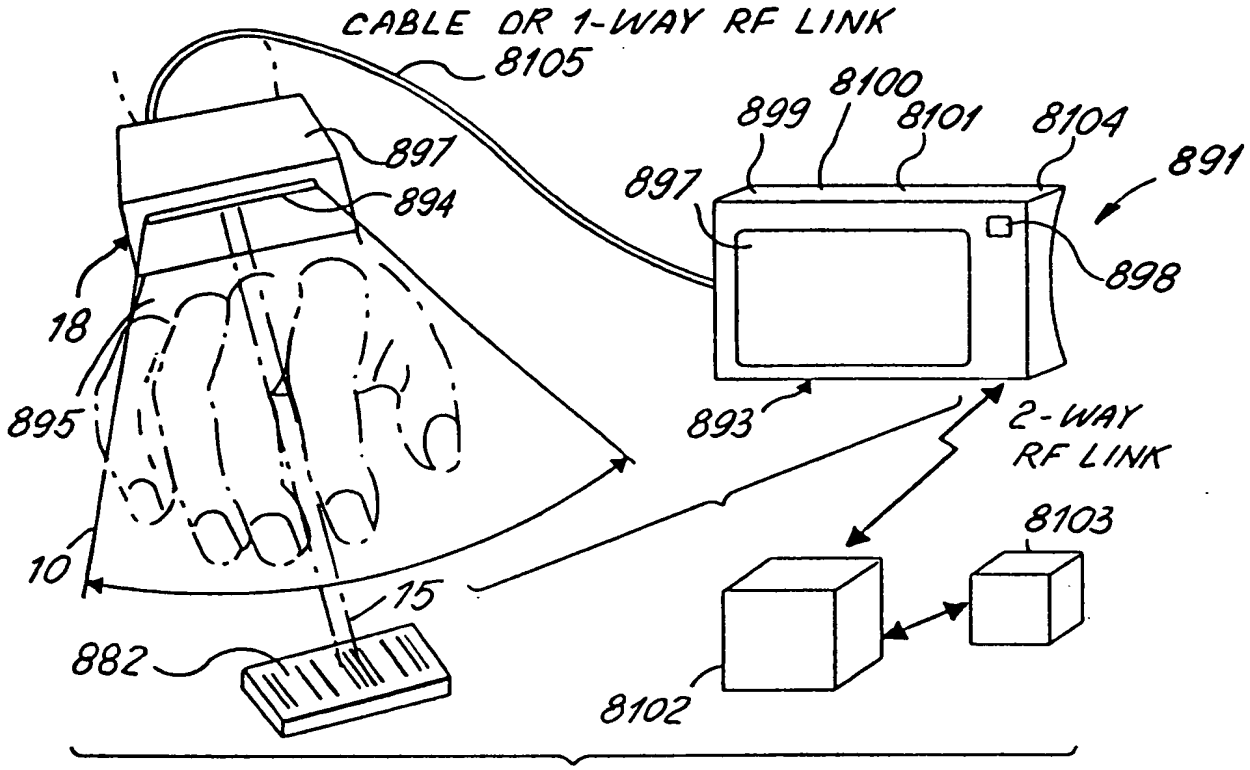

CABLE OR 1-WAY RF LINK
8105
8100
899
8101
8104
891
897
897
894
898
18
895
893
2-WAY
RF LINK
8103
10
15
882
8102

FIG. 19

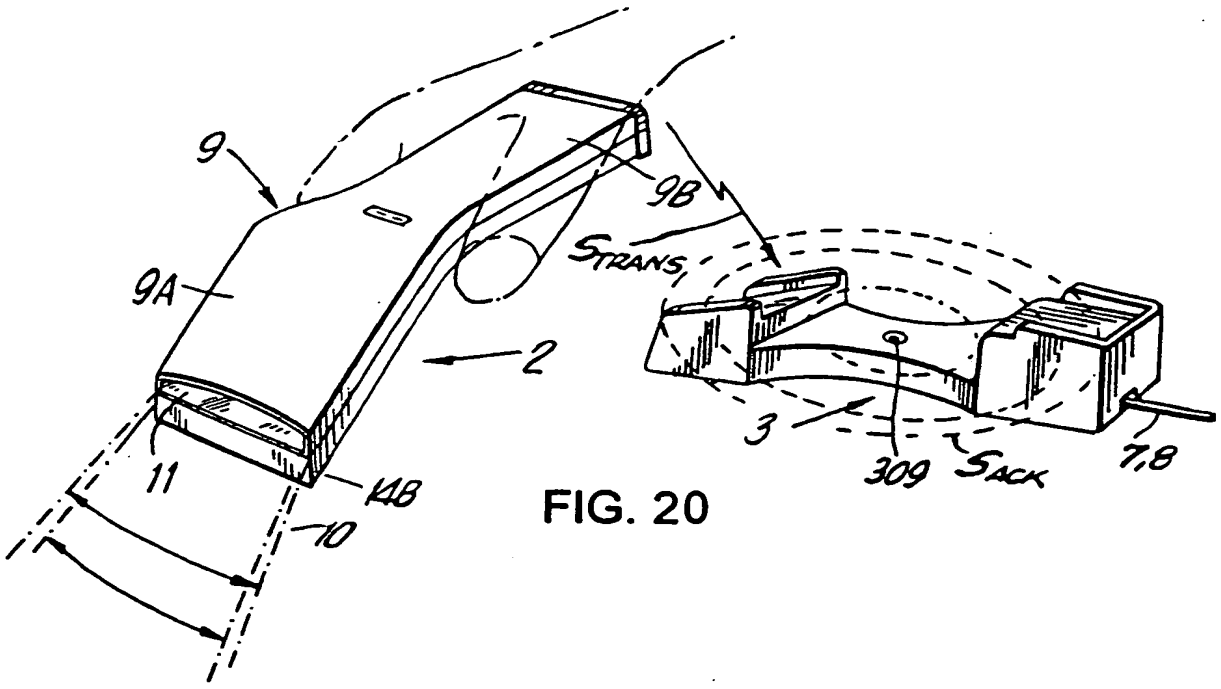

9
9B
STRAP
9A
2
3
309
SACK
7,8
11
10

FIG. 20

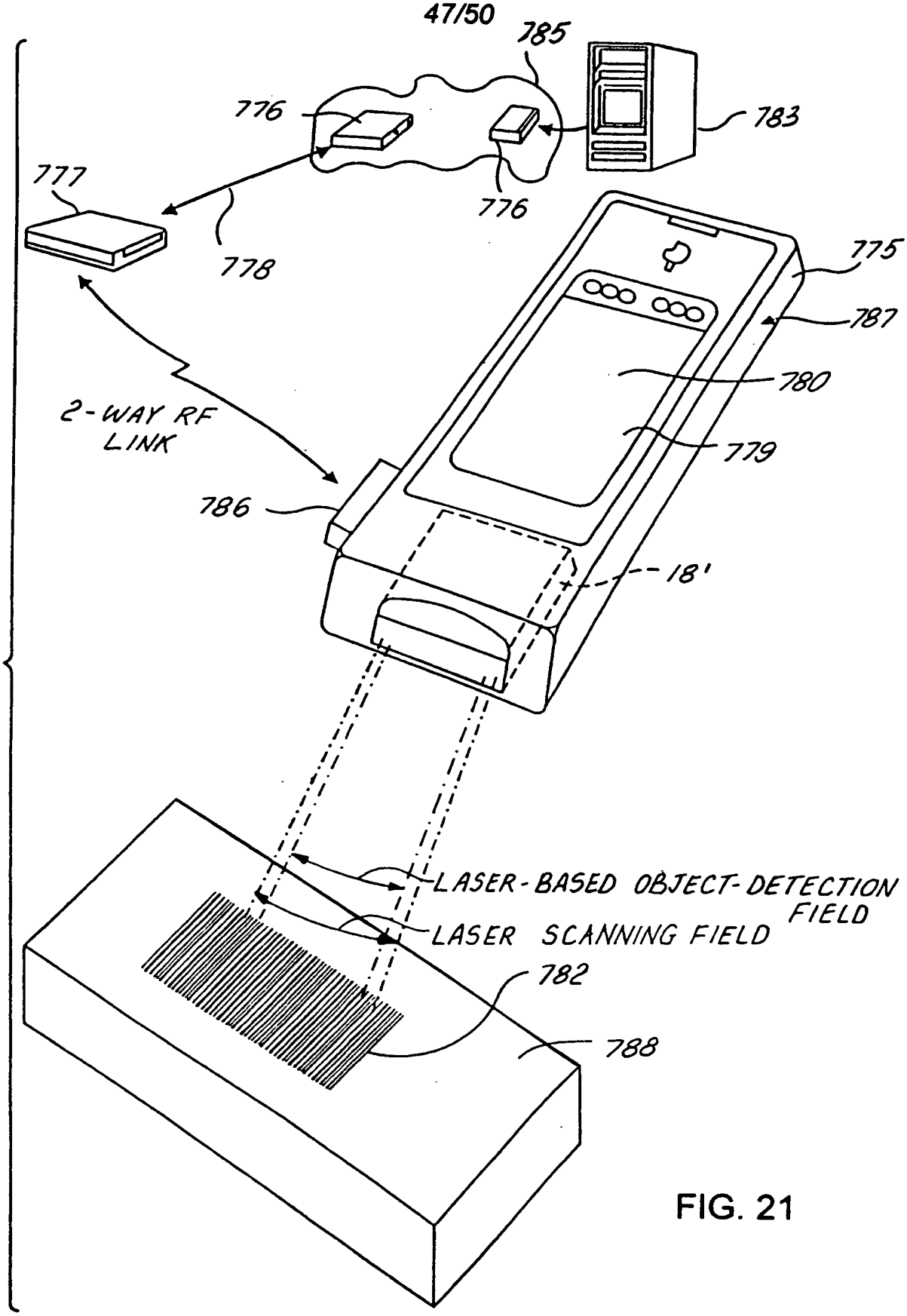

785
776
783
777
776
778
775
787
780
2-WAY RF LINK
779
786
18'
LASER-BASED OBJECT-DETECTION FIELD
LASER SCANNING FIELD
782
788

FIG. 21

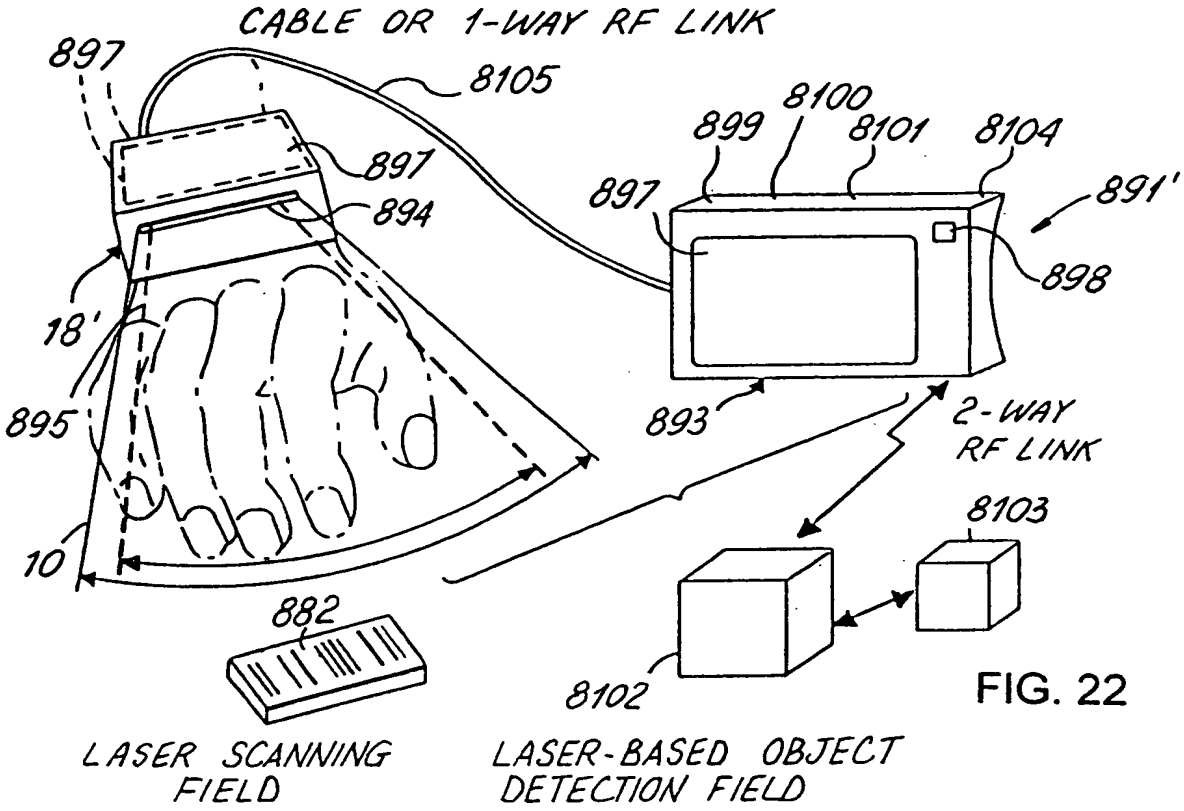

CABLE OR 1-WAY RF LINK
897
8105
8100
899
8101
8104
897
891'
897
894
898
18'
895
893
2-WAY
RF LINK
8103
10
882
8102
LASER SCANNING FIELD
LASER-BASED OBJECT DETECTION FIELD

FIG. 22

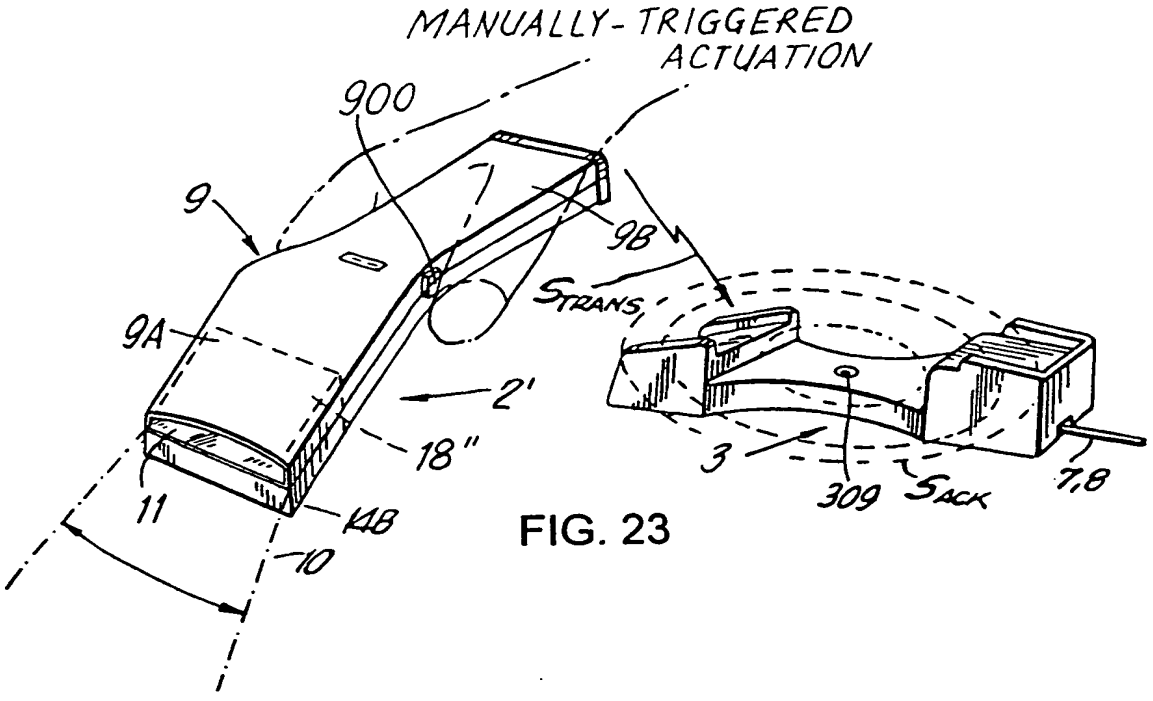

MANUALLY-TRIGGERED ACTUATION
900
9
98
STRANS
9A
2'
18"
3
309
SACK
7,8
11
10

FIG. 23

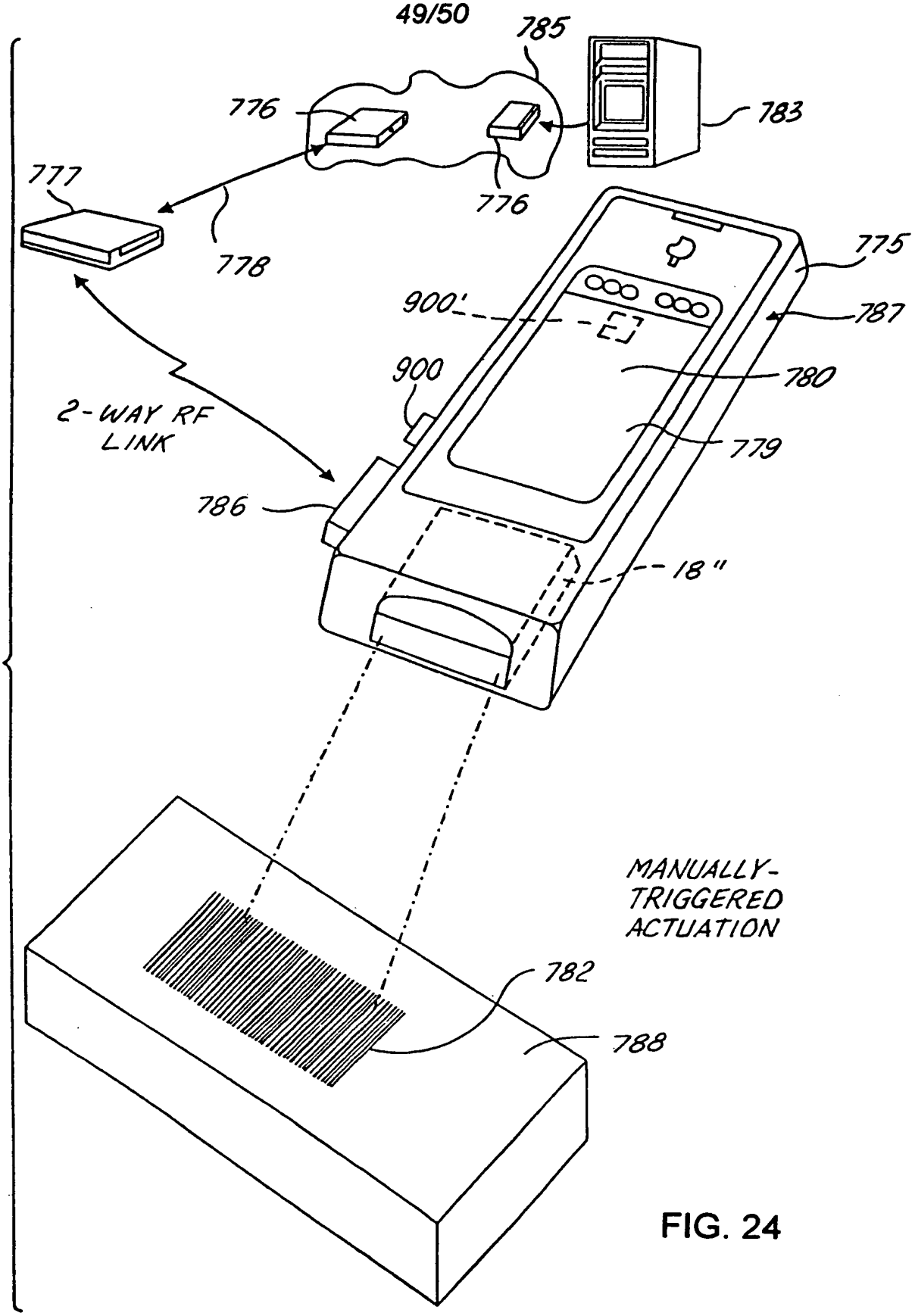

785
776
783
776
777
778
775
900'
787
900
780
2-WAY RF
LINK
779
786
18"
MANUALLY-
TRIGGERED
ACTUATION
782
788

FIG. 24

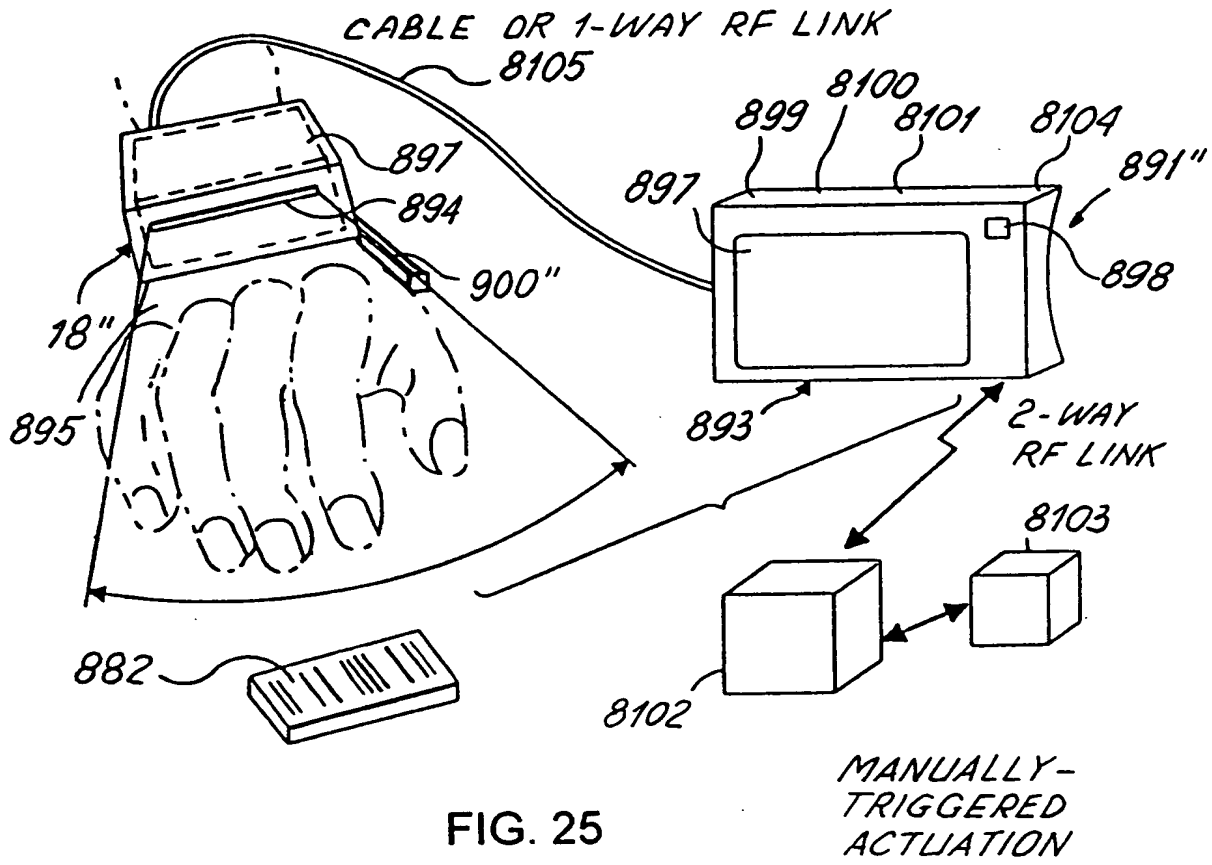

CABLE OR 1-WAY RF LINK
8105
8100
899
8101
8104
891"
897
897
894
898
900"
18"
895
893
2-WAY
RF LINK
8103
882
8102
MANUALLY-
TRIGGERED
ACTUATION

FIG. 25